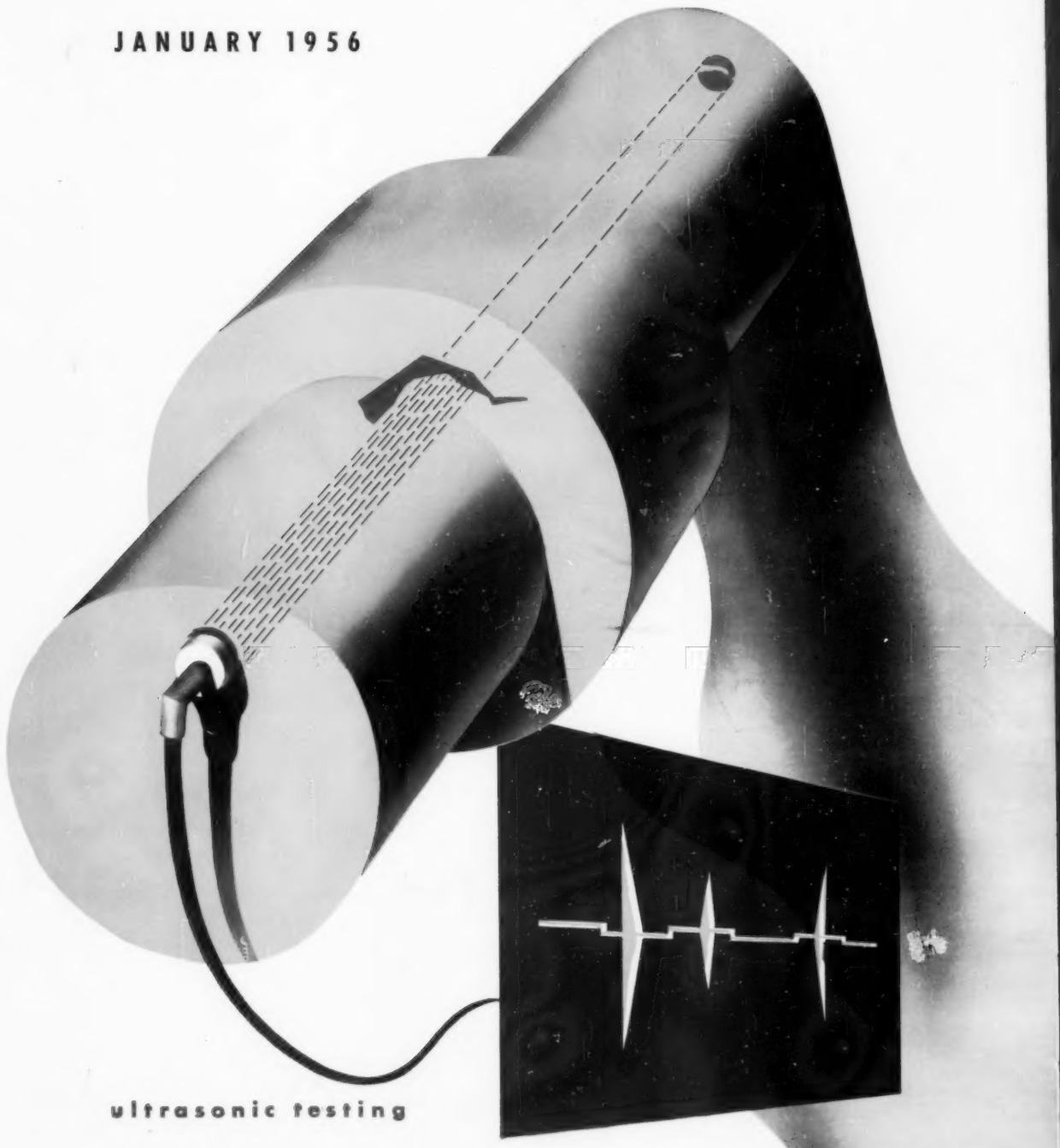
the Tool Engineer

JANUARY 1956



ultrasonic testing

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

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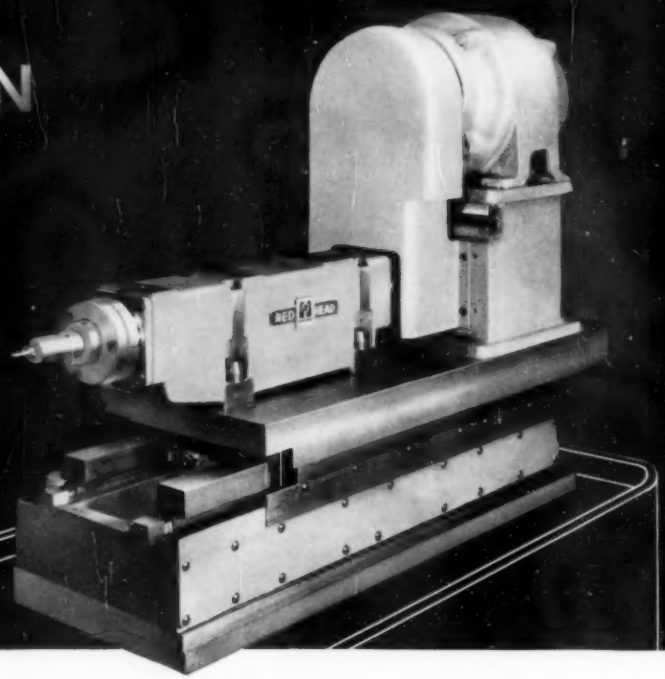
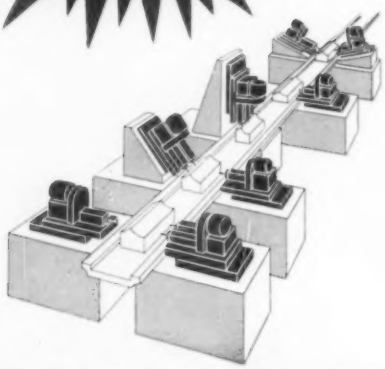


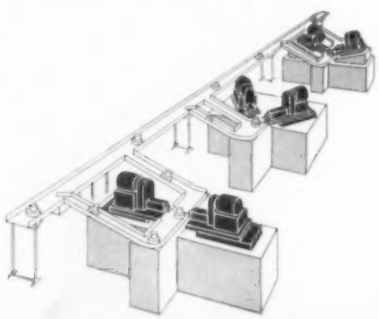
new

HEALD SLIDE-UNIT BORE-MATICS

permit important cost savings and give new flexibility on fully automated production lines



Simplified sketch of typical **transfer-type** automated production line for performing multiple operations on relatively large work. Setup includes horizontal, vertical and angular mounting of individual Slide-Unit machines—each a completely self-contained unit.



Typical arrangement of automatic, **conveyor-fed** production line for performing multiple operations on smaller work. Any number of identical Slide-Unit machines can be provided in each work station, to give the required overall production rate.

THESE simple, compact, hydraulically operated Heald Slide Units — each complete with boringhead and drive — are ideally suited to a wide variety of automated production lines. They can be mounted in any position from vertical to horizontal and can approach the work from any angle. This simplifies the design and operation of automatic workhandling, clamping and locating equipment — permits each work station to be arranged for the most efficient and economical operation.

In an automated line, each Slide-Unit Bore-Matic is a separate and completely self-contained machine, arranged through interlocking control circuits to function as a fully automatic segment of the entire production line. Hence individual machines can be added as required, permitting full automation to be achieved on an economical basis of planned expansion.

This new precision finishing development is another good reason why IT PAYS TO COME TO HEALD.

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COVER: By introducing sound waves at one end of a metal part and projecting the picked-up echoes on a cathode ray tube, internal flaws can be determined. As outlined in the article starting on page 81, the technique can be used to check tools for safety.

The Tool Engineer

Volume XXXVI, No. 1 January 1956

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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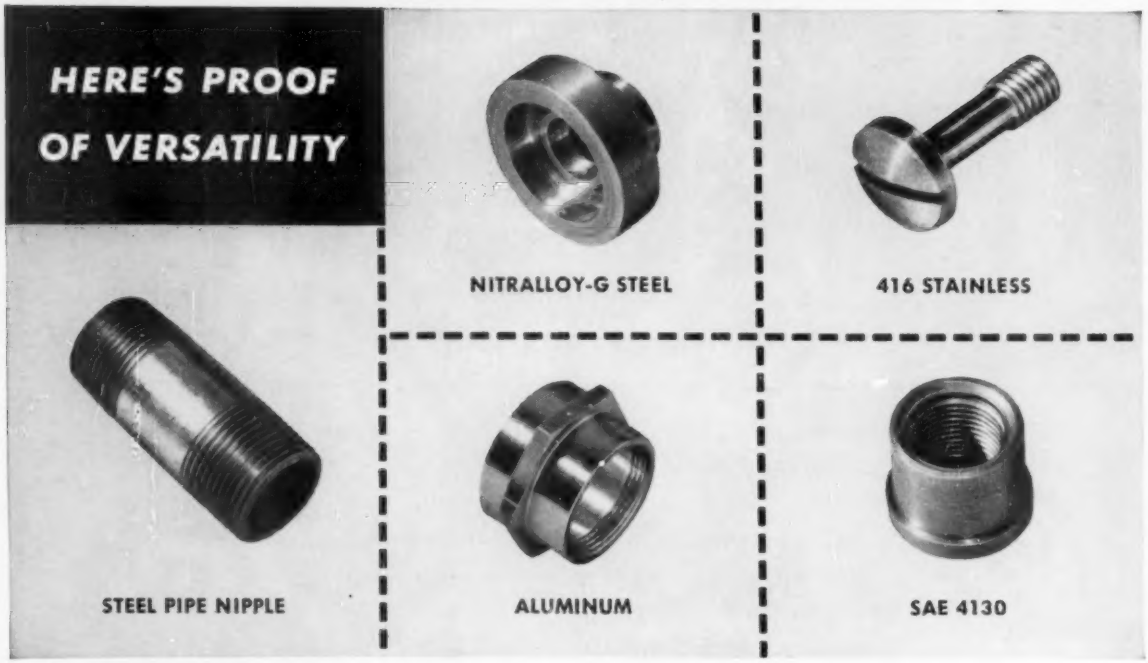

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The Tool Engineer

Preventative Maintenance Pays

Carefully planned preventative maintenance programs have repeatedly proved to be good business. Whether they involve replacement of lamps on a schedule or periodic service checks of production machines, the savings and advantages more than justify the programs. In the case of the former, justification may be measured by dollars saved in maintenance crew payroll and added convenience of personnel dependent on adequate light. For the latter, the savings are measured by what would happen inevitably if maintenance were not adequate.

Damaged costly equipment, spoiled parts and interrupted production schedules result when maintenance is neglected. These hazards are ever present, to say nothing of those leading to serious accidents involving personnel for which no price could ever be paid.

Many shops daily flout fate by neglecting this fundamental of good practice. The only possible excuse is that it involves a cost that may be postponed 'till tomorrow. Such a penny-wise and pound-foolish policy has too often had serious consequences.

When facing accelerated production, many shops overload their machines. When this is done, maintenance schedules should be revised accordingly. The machines should be studied carefully for possibility of early failure. The program would be like insurance. If no weak spots are disclosed, the cost is a premium and the assurance is worth it. If an incipient failure is disclosed, the program costs are insignificant.

An article in this issue discusses a program whereby one shop used ultrasonic test methods for checking the crankshafts on its punch presses. The findings were startling because many weakened shafts were detected. Had they not been replaced, could the costs in damaged presses, sprung frames, ruined dies or even maimed operators be measured?

John W. Greve

EDITOR

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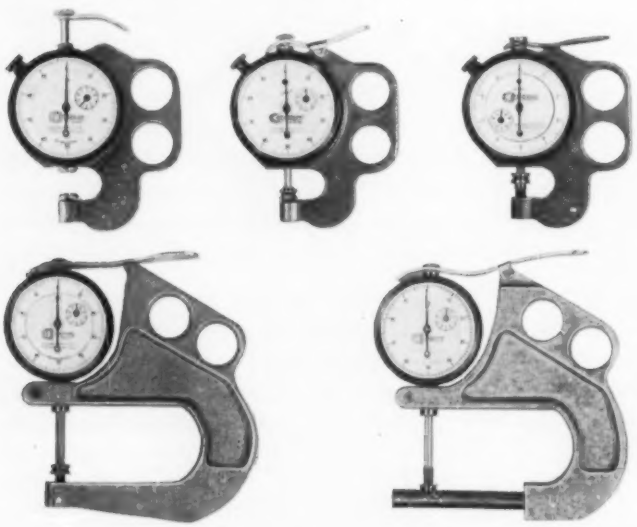

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Here is a series of convenient, easy-to-use gages designed to check the thickness of sheet metal, plastics, and even compressible materials such as leather. They are also useful for measuring diameters, lengths, and other dimensions of small parts. Deep-throated long range models are useful for clearing obstructions. Model shown at lower right is particularly well suited to measuring the wall thickness of tubing. Model shown at upper right is graduated to .0001"; other models graduated to .001".

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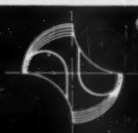
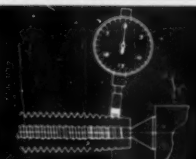


PRECISION CHIP
DRIVER CONTOURS



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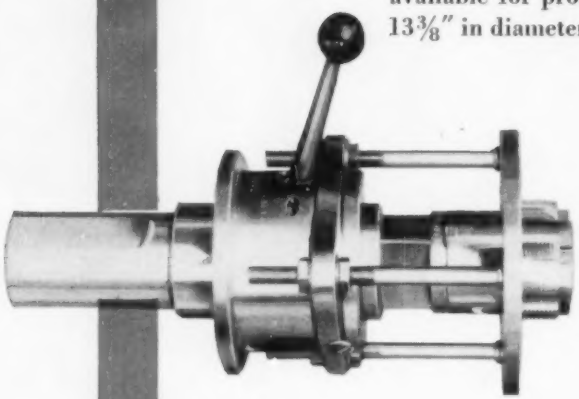
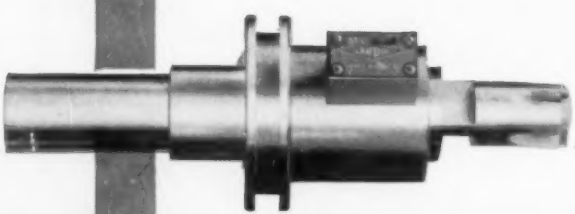
LANDIS Collapsible Taps

The design of LANDIS Collapsible Taps reduces tool wear, "torn" threads and tapping time by permitting direct removal from the workpiece without reversing or "backing out". The sensitivity of this "collapsing action", which automatically withdraws the chasers from the completed thread, assures uniform thread lengths and threading to a shoulder with safety. Various sizes of LANDIS Taps are available for producing straight or tapered threads from $1\frac{1}{4}$" to $13\frac{3}{8}$" in diameter.



ALT TAPS for straight threads

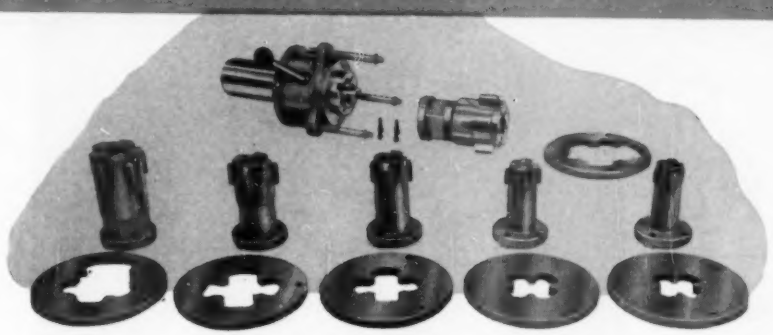
These taps feature a rugged construction and design simplicity which enable maximum chaser rigidity. The same tap may be used for either stationary (shown) or rotary application. Tapered threads can be tapped using chasers cutting across their entire width.



LL TAPS for tapered threads

The thread taper is produced by mechanical receding action of the chasers during threading. This action reduces cutting strains by restricting cutting action to the chaser throat or chamfer section. As little or no "cold working" can result, LL Taps are ideally suited for tapping tapered threads in stainless steel. These taps will also produce straight threads, and are available for either stationary or rotary applications.

Straight or Tapered Threads Rotary or Stationary Use

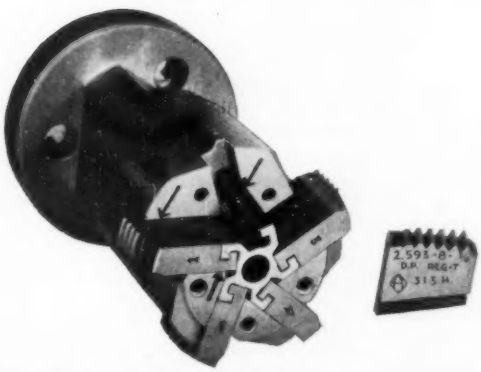


Wide Range Coverage

Detachable heads are a feature of all LANDIS Collapsible taps. This design allows tapping a wide range of thread diameters with minimum tooling—for example, the 3ALT body using 6 different heads will tap all diameters from 1¼" to 3¼". Each tap head itself has a wide threading range—the 1½" head will thread from 1⅜" to 1⅝", the 2" from 1⅞" to 2-5/16", the 3" from 2¾" to 3¼".

Maximum Rigidity

The basic design of all LANDIS Tap Heads assures maximum bearing support between the chaser, plunger and tap head body. In the cross-section illustration, note the heavy metal sections which provide rigidity to the chasers and plunger, particularly at the points where cutting strains are transmitted.



Size Adjustment Ease

All LANDIS Taps are designed so that they may be quickly adjusted approximately 1/32" over or under the nominal chaser size. The ratchet-type size-adjusting screw is conveniently located in the front of the tap. The movement of one ratchet tooth provides a self-locking diametrical adjustment of .001".

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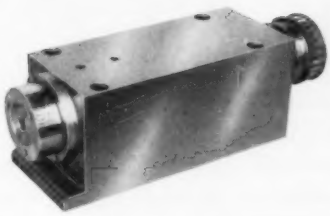

EXHIBIT B

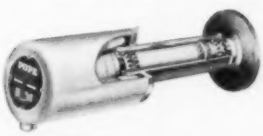

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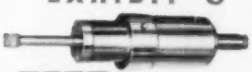
EXHIBIT G



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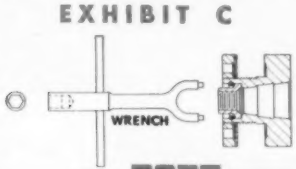

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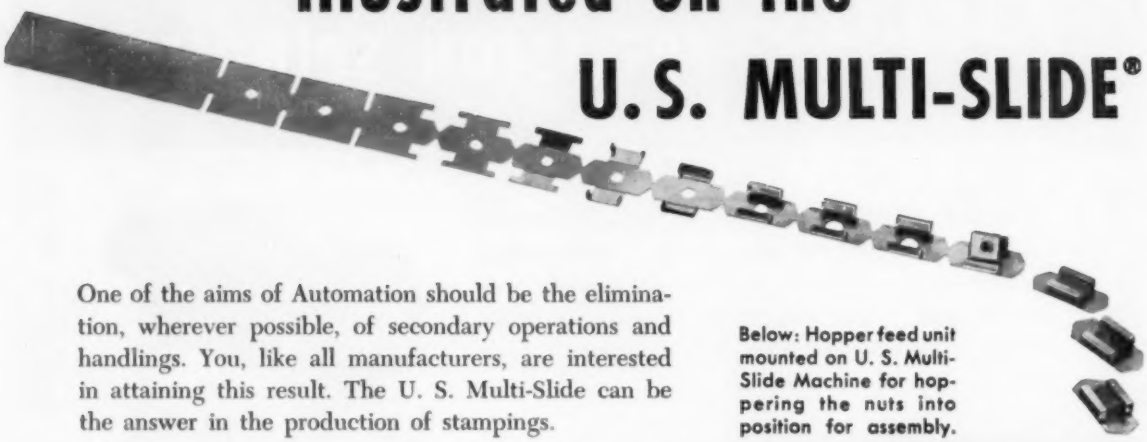


One of the aims of Automation should be the elimination, wherever possible, of secondary operations and handlings. You, like all manufacturers, are interested in attaining this result. The U. S. Multi-Slide can be the answer in the production of stampings.

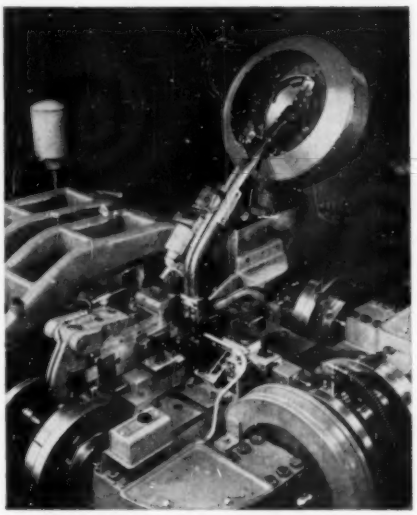
The sequence-of-operations strip pictured above shows how a complete assembly is produced on the U. S. Multi-Slide without secondary operations. The finished assembly is an automotive fastener comprised of a sheet metal stamping and a nut. The stamping is produced on the U. S. Multi-Slide and the prefabricated nut is hopper-fed into proper position for automatic assembly. The complete unit is produced at the rate of 100 per minute – without handling.

The elimination of secondary operations results in reduced cost per piece, an all-important factor in today's competitive market. If you produce stampings and are interested in low piece part costs, why not investigate the use of U. S. Multi-Slide Machines?

TE-Jan.

Ask for Bulletin 15-T giving complete specifications.

Below: Hopper feed unit mounted on U. S. Multi-Slide Machine for hoppering the nuts into position for assembly.



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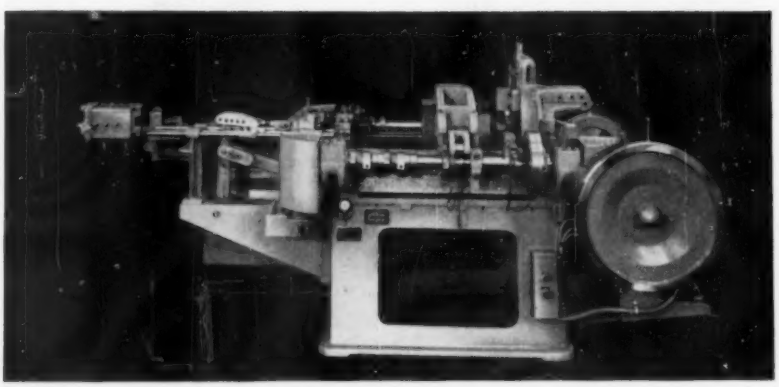
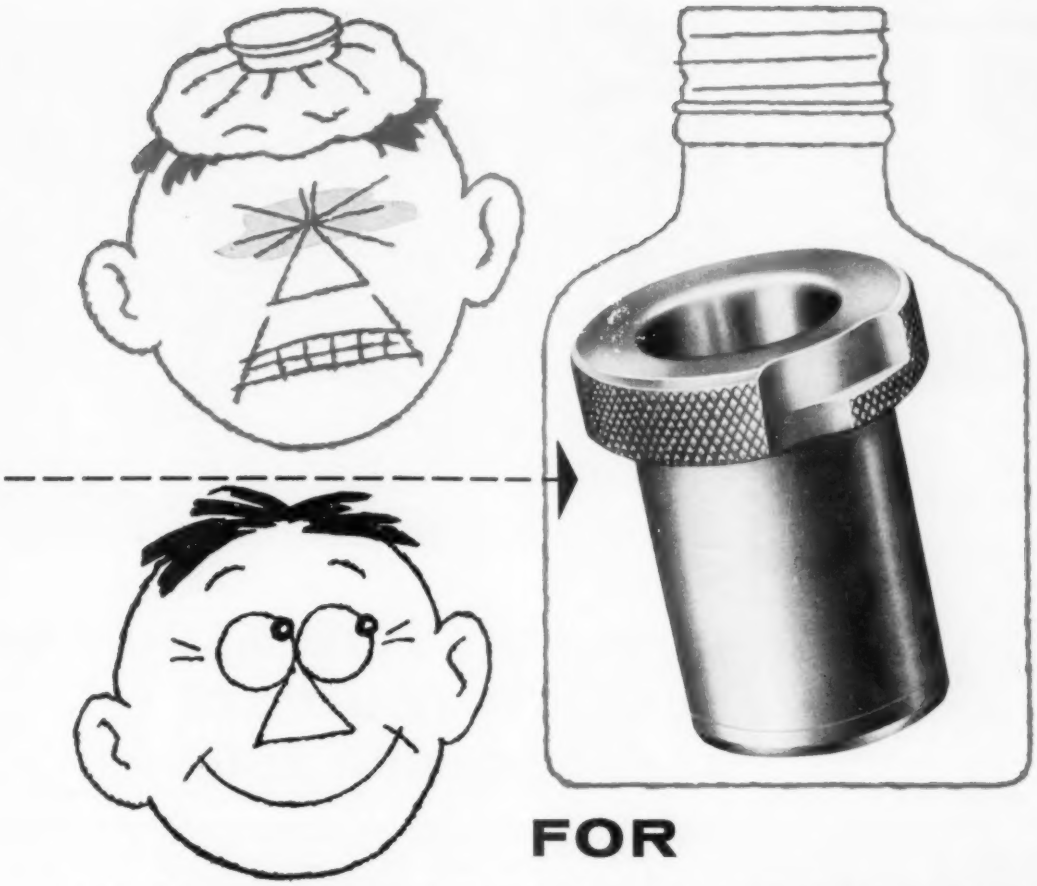


Left: Standard No. 33 U. S. Multi-Slide Machine on which the hopper feed unit is installed.



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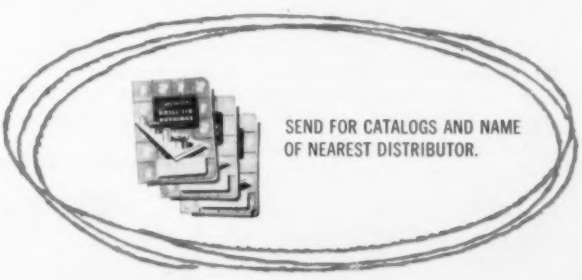


SEND FOR CATALOGS AND NAME OF NEAREST DISTRIBUTOR.

Talking About Die Sets

WITH

PHIL MARSILIUS

Vice-President
The Producto Machine Co.

Proper Care of Die Sets—How can you be sure your die set will be as accurate the day you tool it as it was when the manufacturer assembled it? While he guarantees the set he has shipped to you, the manufacturer has no control over the treatment it receives after it leaves his plant.

Unusually rough treatment or exposure to moisture—which can occur in transit, on your receiving dock, in your stockroom or in your toolroom—can easily destroy the die set's accuracy. Though these occurrences are rare, you should protect yourself against them by a prescribed routine.

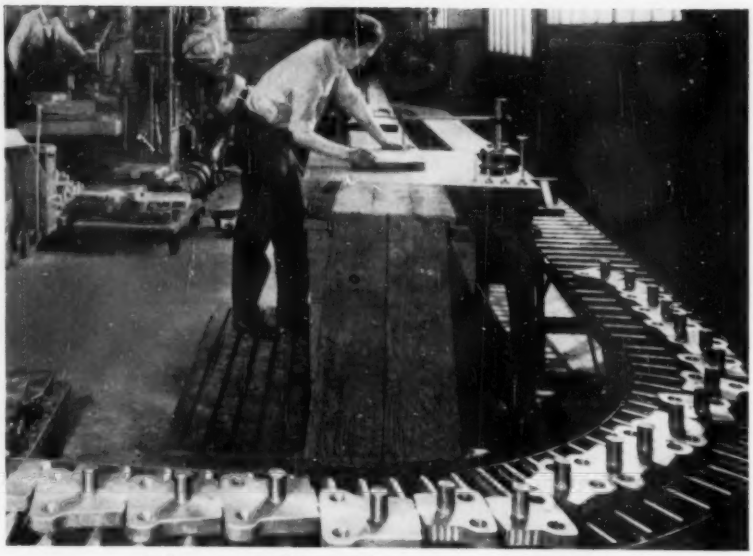
When a die set reaches your receiving dock, inspect it immediately. If rust or misalignment has occurred and is not detected until the set is ready to be tooled, you may have serious production delays.

We recommend the following procedure: 1) Uncrate the die set; 2) Clean the set without disassembling; 3) Check it for parallelism; 4) Check it for free movement of punch holder; 5) Lubricate the pins and bushings; 6) Coat all critical surfaces with a light protective film of oil; 7) Store the set in a dry area on wooden blocks or pallets. You can then be sure that every die set is always ready for use.

If inspection shows something is wrong with the set, contact the manufacturer immediately for permission to return it for repair or have a replacement issued.

When production with the die has been completed, repetition of the above procedure will insure that the tooled die set will be ready for immediate use when needed again.

By these simple steps, you can preserve the degree of accuracy built into the die set.



Where mass production and consistent quality join hands: one of Producto's die set inspection stations.

HOW PRODUCTO MAINTAINS CONSISTENT DIE SET ACCURACY FOR YOU

Though mass production of die sets makes possible larger stocks and faster delivery, it may also be the cause of sub-standard quality. *Only 100% inspection,* as practiced by Producto, can *consistently* maintain the accuracy of mass-produced parts.

At Producto, every die set component—die bed, punch holder, guide pin, bushing—is checked first at the point of manufacture, then at a secondary inspection station, and finally, at the assembly station. Not only are parts checked with highly-accurate surface plates and gages against precision standards, but also visually for flaws that might mar appearance.

Whether you specify two Producto die sets or two hundred, you can be sure they will be *consistently* accurate to the highest standards of the die set industry.

If you're looking for valuable ideas on die sets and their application, write for our free quarterly, *Die Set Digest.* And if you're looking for precision die sets fast, remember to call your nearest Producto branch.

THE PRODUCTO MACHINE COMPANY
930 Housatonic Avenue, Bridgeport 1, Connecticut
Telephone FOrest 7-8675

For prompt die set service, 'phone these PRODUCTO assembly warehouses:

Atlanta	CY 7667	Detroit	LI 6-7600	Philadelphia	MO 4-1010
Chicago	ES 8-3307	Kansas City	BA 9033	Rochester	GL 1810
Cleveland	SU 1-6158	Los Angeles	TR 9826	St. Louis	FR 1-3370
Dayton	MU 1651	New York	WO 4-7484	or check the Yellow Pages in	

any stamping center in the United States or Canada for distributors stocking PRODUCTO.

Produce More With

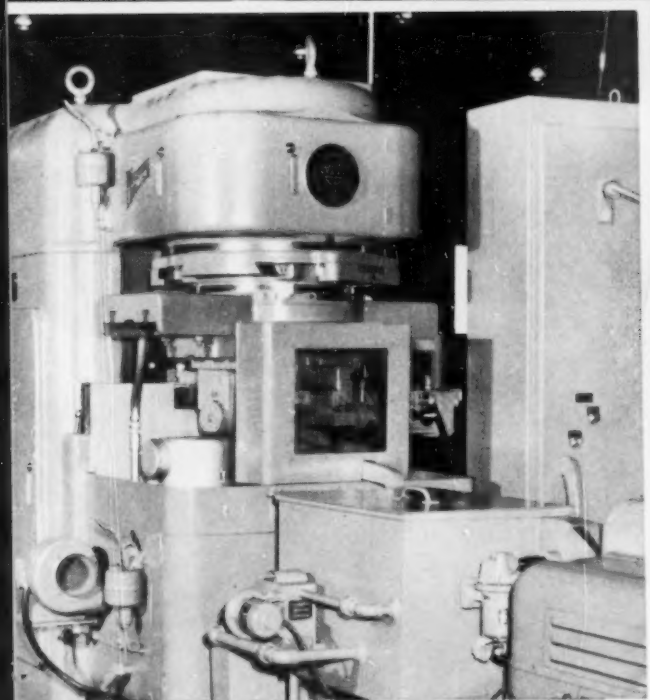
PRODUCTO

Precision Die Sets

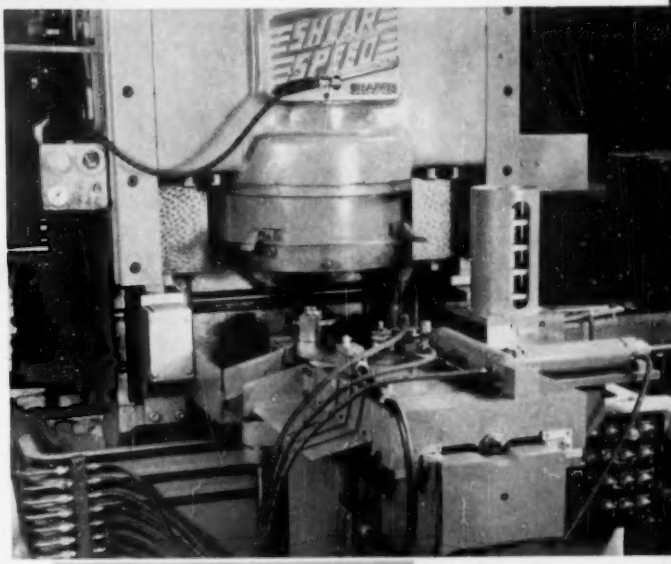
This Month's

GEAR PIX

NEW LARGER ROTO-FLO spline roller, Model 1551, is capable of cold rolling toothed parts with diameters up to 2 inches. Complete information on this fastest method of forming splines and similar toothed parts is given in Bulletin RF-55.



CONTINUOUS, AUTOMATIC, FAST gear shaving on this Michigan 870-A gear finisher includes automatic size control, hopper feed, washing, and checking for correct size and helix angle. These Michigan gear shavers are used in continuous gear production lines—or in unitized groupings.



NEW AUTOMATIC LOADING for Shear-Speed gear shapers, plus automatic size control, offers completely automatic operation on all 1800 series models. Can be specified on new machines or added to Shear-Speeds now in the field.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.

This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

MACHINING, THREAD ROLLING IN ONE OPERATION

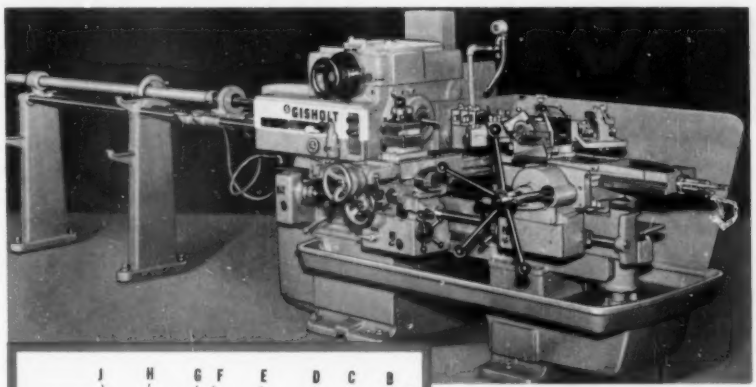
New Ram Type Turret Lathe Cuts Costs on Brass Bar Job

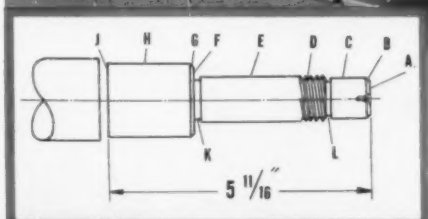
Time is saved and costs are cut on this typical brass bar job—by taking advantage of a smart setup combined with 16 spindle speeds from 60 to 3000 r.p.m., a 20 h.p. motor and a 3-second shift cycle. The machine is the new Gisholt MASTERLINE No. 4 Ram Type Turret Lathe.

A single lever at the front of the headstock controls the hydraulic collet chuck and bar feed. When the collet chuck is opened, a built-in stock stop and scale arrangement lets the bar feed carriage automatically advance stock the required distance. When the chuck closes, the bar feed automatically returns for the next stock advance—providing more accurate feeding and in this case eliminating the usual stock stop mounted on the hexagon turret.

Here's how the part—a brass worm wheel shaft—is machined and threaded in a single operation: from the hexagon turret, tools chamfer B, turn E and rough face F. Diameters C-D-H are finish turned and the work is centered. Then a 12 TPI class 4 fit thread is rolled on D with a special self-opening thread rolling head, approximately 5 times faster than conventional chasing speeds. Still more time is saved with an electrical rapid traverse on the cross slide, where tools groove K-L, chamfer B-G from the rear and cut off at J from the front to complete the job. Floor-to-floor time: just 2.37 minutes.

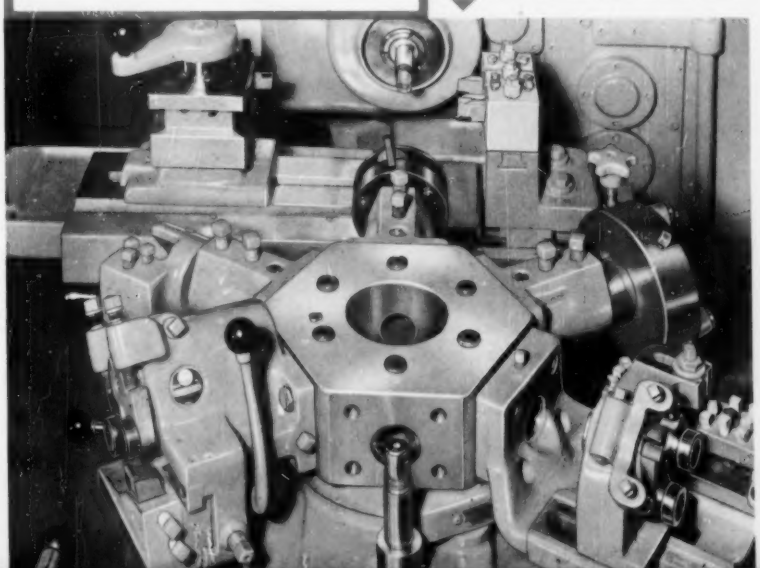
Worm wheel shaft production is boosted on this job through advanced features of the new MASTERLINE Ram Type Turret Lathe.





General machine view of new Gisholt MASTERLINE No. 4 Ram Type Turret Lathe, tooled to machine brass worm wheel shaft. Write for Bulletin 1174B.

Special thread rolling head, shown facing work. Note finished part in foreground.



MASTERLINE GISHOLT SINCE 1887

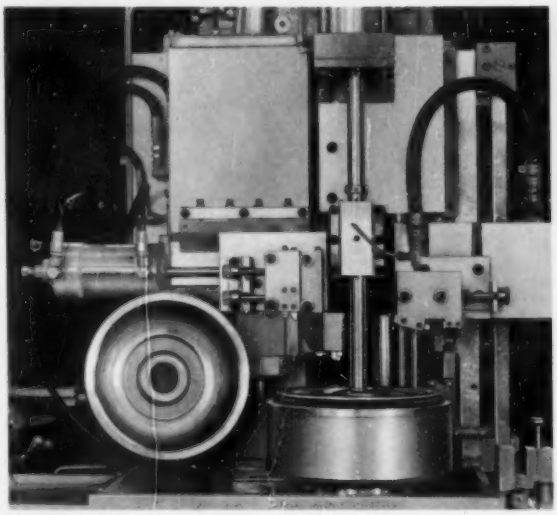
TIME-SAVING IDEAS

VERTICAL DESIGN MACHINE FACILITATES WORKPIECE HANDLING

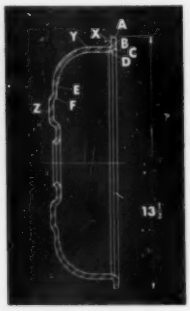
New 12V Automatic Lathe Provides High Production — Requires Minimum Floor Space

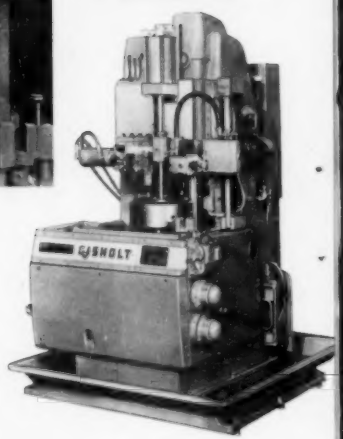
Designed for easy loading and unloading of flat, heavy workpieces, the new Gisholt MASTERLINE No. 12V Automatic Production Lathe handles a wide range of machining operations quickly and efficiently.

Here, the workpiece is a steel torus cover produced by a well-known automatic transmission manufacturer. To eliminate distortion, the work is placed in a pot-type fixture. The underside of the flange rests against a vibration dampener at X. A spring-loaded tapered ring centralizes at Y. The work is held securely from above —with positive location against Z— by an air-operated heavy-duty tailstock with a rotating head. Tools on the front carriage bore D and chamfer A. At the same time, tools on the rear independent slide are traversed to depth. Tools on an auxiliary slide mounted on the rear independent slide move transversely to face B-E and form C-F, completing the part. Floor-to-floor time on this job? Only 0.60 minutes.



Workpiece and tooling. Note how piece is held in pot-type fixture.





New Gisholt No. 12V Automatic Lathe—compact, versatile, readily adapted to automatic handling. Ask for new Bulletin 1175.

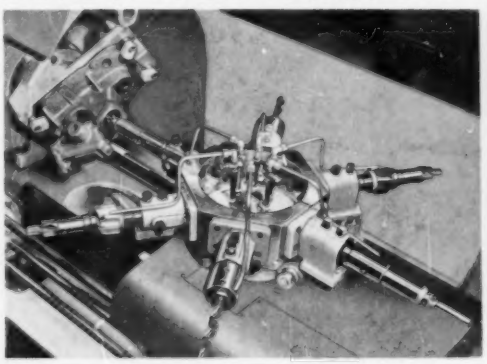
Gisholt No. 12V MASTERLINE Automatic Production Lathe—requiring minimum floor space—permits easy addition to existing production lines.

SPECIAL SETUP SOLVES ODD-SHAPE PROBLEM

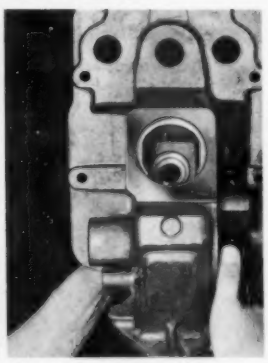
Chucking Fixture on Fastermatic Simplifies Close Tolerance Machining on Gear Housings

Next time you're faced with machining an odd-shaped part, remember this Production Pointer. The workpiece is a cast iron steering gear housing. The machine—a new Gisholt 2F Fastermatic Automatic Turret Lathe—is tooled for drilling, boring and chamfering operations, and equipped with a special chucking fixture. Pins on the fixture provide rough location in the previously machined base holes, and correct angular location is taken from the previously machined workpiece base.

Four manually operated clamps hold the work. After rough drilling on the first hexagon turret station, multi-diameter cutters machine 3 diameters at the rear of the workpiece and one at the front, and also form and chamfer. The operation is then completed with piloted Microbore tooling, which finish bores 2 diameters at the rear and one at the front. Floor-to-floor time is just 3.25 minutes—with a 0.0005-inch tolerance held in the small rear bore.



Note Fastermatic tooling—and also how the workpiece is held on a special fixture.

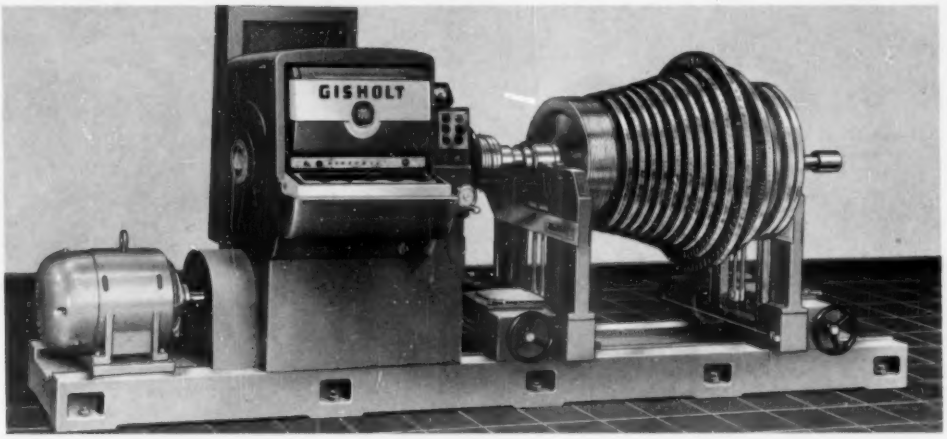


Workpiece, showing surfaces machined at front and rear.

Machining simplified with special feature on Fastermatic. Hexagon turret double-tooled to complete 2 parts with each complete index of turret.

TIME-SAVING IDEAS

IMPROVED BALANCER SIMPLIFIES OPERATION



Write for complete information—ask for Advance Data Bulletin No. T-1176-A and the new General Balancing Catalog.

Advanced Features on DYNETRIC Type "U" Reduce Setup Time, Cut Costs

Ordinarily, handling a balancing job like this would be quite an order. Instead, this massive steam turbine spindle is typical of work handled quickly—and easily—on the Improved Gisholt DYNETRIC Type "U" Balancing Machines. The machine above is the largest of 3 standard stock models, designed to handle work weighing from 500 to 10,000 pounds with bearing diameters to 14".

Simplified controls provide faster setup, permitting the operator to locate the angle and measure the amount of unbalance in each of 2 preselected planes—with greater ease and efficiency than ever before. Other important new features include setup dials arranged in definite "Left Plane" and "Right Plane" groups; fewer controls to permit setup on a new part in less than 15 minutes, and a re-run setup in less than 5 minutes; simplified operating controls more conveniently located; and an Amount of Unbalance Meter and Angle Indicating Protractor in the same visual field to reduce operator fatigue.

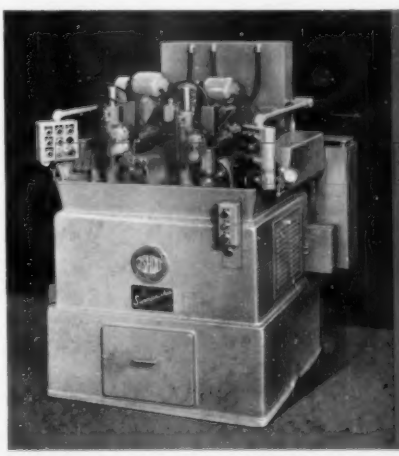
Reduced costs, increased production, easier operation and consistent accuracy make the complete line of Improved Gisholt Type "U" Balancing Machines worth your thorough investigation now.

TWO JOBS WITH ONE MACHINE, ONE OPERATOR = LOWER COSTS

New Superfinisher Handles Two Different Transmission Parts Simultaneously

Here is a smart Superfinishing setup for 2 different automotive transmission parts—a converter impeller hub and a drum and sun gear assembly housing. The machine is the new Gisholt No. 54 Two Spindle High Production Superfinisher. Both stations are handled by one operator—alternately loading, starting the automatic cycle and unloading the Superfinished parts.

The left-hand station Superfinishes the impeller hub O.D. from 30 micro inches RMS down to 3 micro inches RMS, and the right-hand station Superfinishes an I.D. in the gear housing from 125 micro inches RMS down to 12 micro inches RMS or less. For each station, floor-to-floor time is a short 45 seconds.



Separate push-button panels on Gisholt No. 54 Superfinisher simplify setup and control.

Impeller hub (above) and gear housing, both Superfinished in this setup.

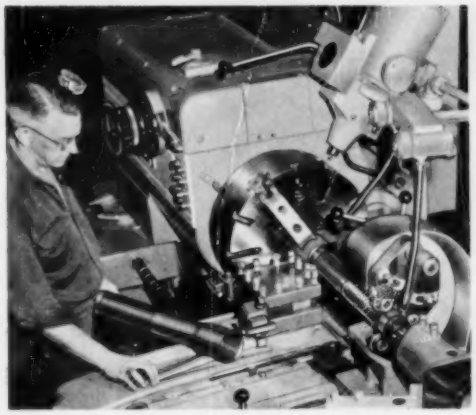
One machine—requiring minimum floor space and at a lower initial investment—

Superfinishes 2 different workpieces economically at high production rates.

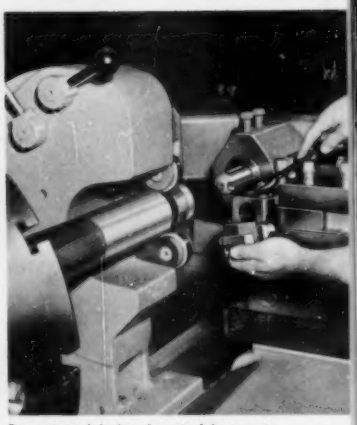
TIME-SAVING IDEAS

LONG WORKPIECES EXPERTLY HANDLED WITH THIS SETUP

Square Turret Tools on 3L Saddle Pre-Set for Fast Change-over



Close-up of the first and second operation workpieces, square turret tooling and steadyrest. Note power chucking arrangement.



Pre-set tool being inserted in turret tool post mounting block.

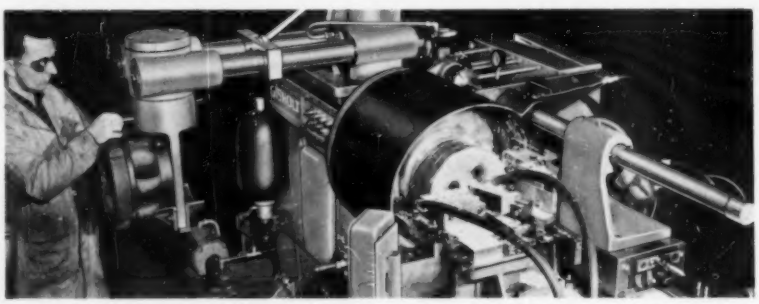
Cast iron packer bodies are completely machined in 2 operations on this Gisholt MASTERLINE 3L Saddle Type Turret Lathe. No time is lost, since tooling is expertly planned for maximum metal removal at each station. Change-over is also speeded up through pre-set tools, set in special mounting blocks on the square turret tool post. A cross-feeding hexagon turret permits use of same tools for different sized workpieces. Transverse location is simplified with a "tenth" indicator on the turret saddle. Threading from either the tool post or hexagon turret is provided by a full-length lead screw.

First operation consists of turning several outside diameters, forming, relieving and threading a portion of the small end O.D. from the square turret. With an open-side steadyrest supporting, an 8"-long buttress thread is cut from the square turret, ending where the packer body O.D. enlarges. Hexagon turret tools then bore and ream the I.D., and chamfer and face the end. The work is then turned end-for-end for the second operation. Square turret tools turn the large O.D., face and chamfer. Hexagon turret tools then bore, taper bore, relieve and taper thread the large I.D. to complete the part.

Expert planning and pre-set tools—plus features like a cross-feeding hexagon turret—minimize f.t.f. time on these long workpieces.

SWINGING LOADER BOOSTS PRODUCTION

Power-operated Fixture on Standard Simplimatic Saves .5 Minute Per Part



Operator removes finished part from loading fixture while next part is being machined.

With this unique work-handling device on a standard Gisholt Simplimatic Automatic Lathe, cast iron cylinder head production has been increased 15%. Mounted on the headstock—and moving in an arc from machine center line out 90° to the front—is a power-operated swinging arm, which in turn mounts a 2-sided loading fixture manually indexed 360°. With the arm parallel to the machine center line, the loading fixture may be power traversed, longitudinally, in or out from the face of the chuck.

When the part is completed, the spindle stops and the loading fixture swings parallel with the spindle center line and traverses to the chuck. The operator then releases a pin (which holds the part as it is unchucked and traversed to clear the tooling)—manually indexes the fixture 180°—and the rough part is traversed to the chuck. Chucking is done with the pin released. The fixture, with the finished part, traverses back to clear the tools and swings out towards the operator for unloading, to complete the cycle.

By absorbing a major portion of loading-unloading time into actual machining cycle, this loading device on the Simplimatic provides maximum production.

No. 1-256
653

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

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You get more cuts and cleaner cuts. Triple C is non-gumming, non-galling, anti-rust. Friction is reduced. . . . Extreme pressure lubricity gives you longer tool life.

Triple C Cutting Coolant is water-soluble, non-oily and non-greasy. It is not subject to the development of any foul odor. Work pieces are not slippery; are easy to handle.

Your men will like Triple C Cutting Coolant, because it eliminates all fire hazards; is smokeless and foamless. Its vapor is harmless to the operator. There is no danger of skin infection. Work-pieces are clearly visible.

Triple C Cutting Coolant—the long awaited answer which sidelines serious obstacles to today's steadily increasing feeds and speeds. Tested and proven amazingly effective in nation-wide operation, Triple C actually revolutionizes technology in this field. Every molecule is a complete unit that contains all the elements requisite to ideal cooling and lubrication. Triple C solutions never break or separate. Lengthen your tool life! Step up production! Maintain accuracy and safety to your operators! *Triple C Cutting Coolant does all three!*

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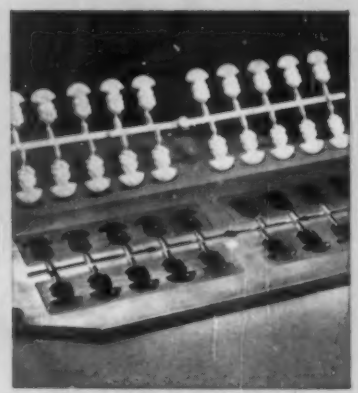
How much money can



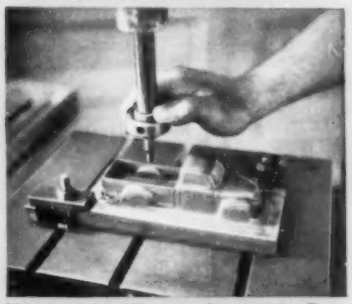
Injection molding dies of Epon resin (left) reduce costs 80% for Adams Plastic Products, Cincinnati, Ohio. Duplicate patterns (center) are made to close tolerances with Epon resin by Crane Company, Chicago, Ill. Epon resin dies for outboard motor housing (right) are one-third cost of comparable metal dies for Clinton Machine Company, Maquoketa, Ia. Formulations for these three applications supplied by Kish Industries, Inc., Lansing, Mich.

Epon resin gives you these advantages for making tools and dies . . .

- Cast and cured at room temperature . . . no special equipment needed
- Cast to close tolerances . . . less machining and handwork
- Easily duplicated and altered . . . short production time

Epon resins are the epoxy polymers made exclusively by Shell Chemical Corporation.

Epon resin stretch dies developed and used by Lockheed Aircraft Corporation, Burbank, California, show high dimensional stability and strength.



Toy models of Epon resin made by Ber-Design Associates, Irvington, N.J., stand up in duplicating machine during hob-making process at Columbia Engineering Company, Newark, N. J.

you save using

EPON® RESIN

to make TOOLS and DIES?

New resin can reduce tool production costs by 80%

PLASTIC TOOLING now has graduated from the short-run experimental stage to the profitable production stage . . . thanks to the unusual physical properties of Epon resin.

Saves time and labor

Little machining and handwork are required to finish Epon resin tools, dies, and patterns, because the material can be cast to very close tolerances. No specialized equipment is needed, because Epon resin tools are cured at room temperature.

Tools resist wear

Other advantages of Epon resin tools are that they withstand great pressures, are unaffected by chemicals and a wide range of temperatures, and maintain a high resistance to abrasion and corrosion.

Where Epon resin tools are used

Draw dies, drop-hammer dies, and injection molding dies for polystyrene . . . are some of the Epon resin tools now serving a variety of industries. Drilling, welding, routing and checking fixtures, foundry patterns, and vacuum-molding dies . . . all made of Epon resin, are also in daily production.

Find out more

Savings of 80% over the cost of comparable metal tools have been reported by tool- and die-makers. How much can you save in your operations? Best way to find out—write your Shell representative for more information on Epon resin applications.

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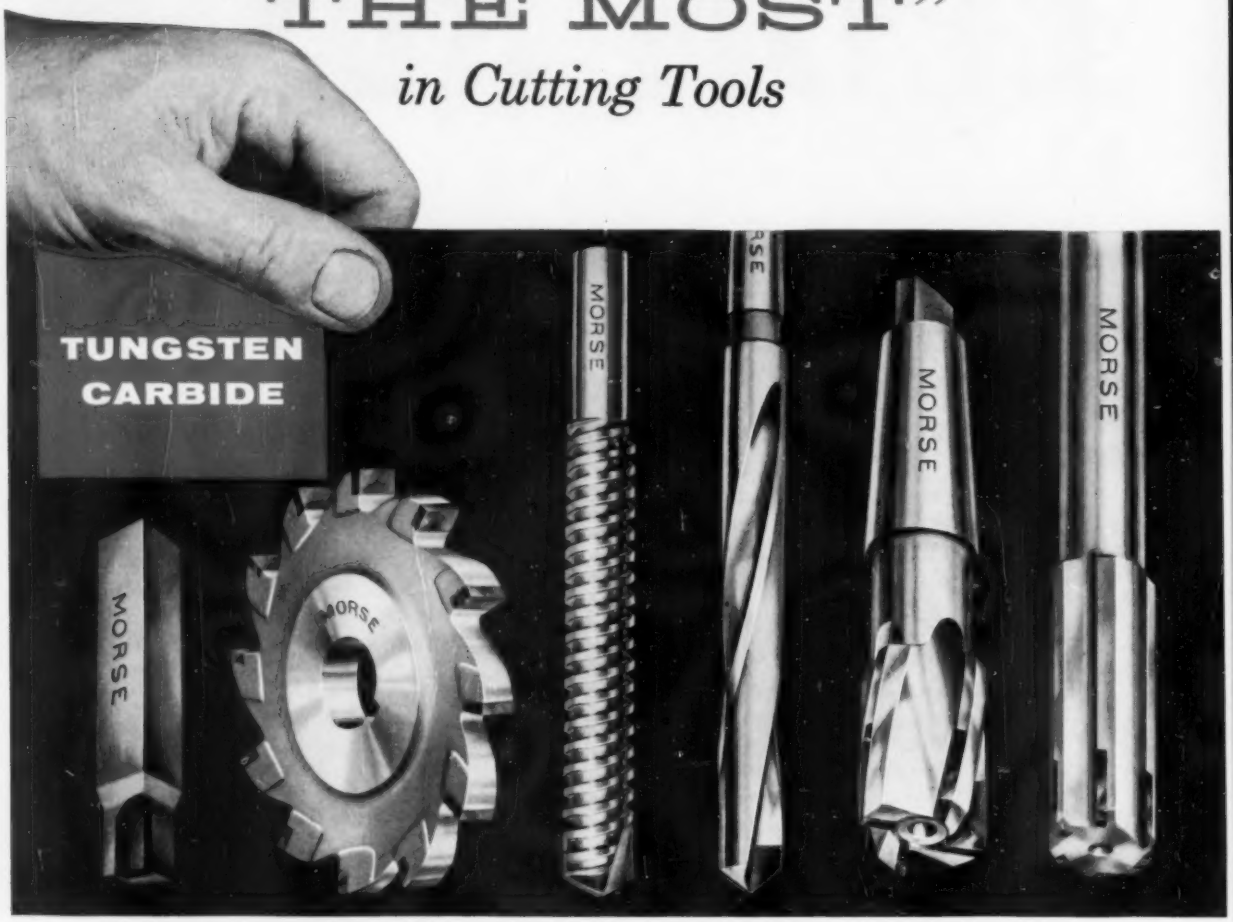

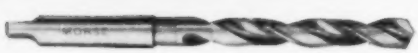

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YOU CAN POSITION A WORKPIECE

TO WITHIN .000125″ IN A FEW SECONDS

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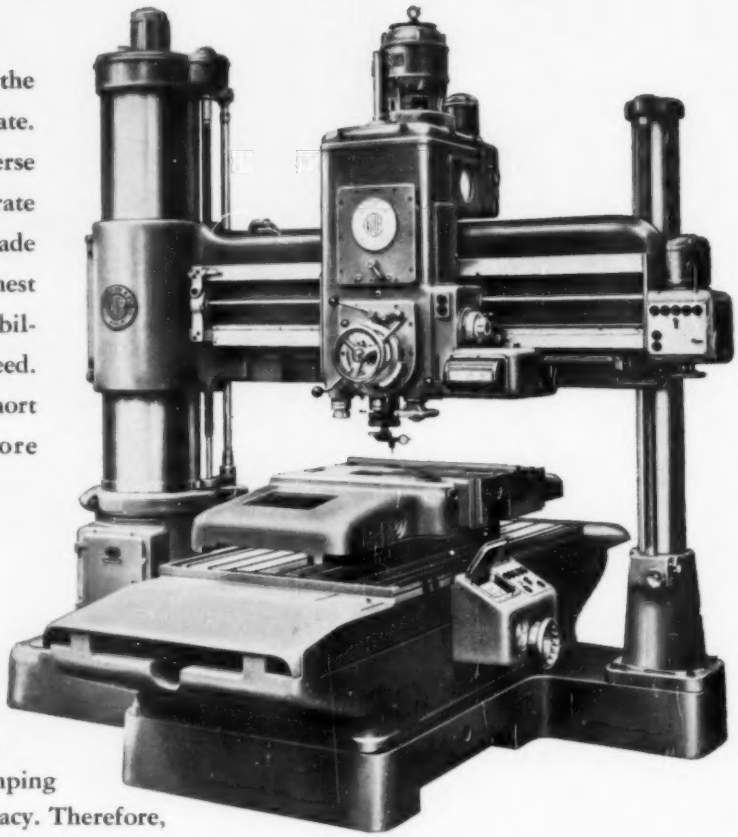

- Shock and distortion-free electro-hydraulic clamping does not impair accuracy. Therefore, reading accuracy equals positioning accuracy. Signal lights indicate if head and table are clamped or unclamped.
- Convenient pushbutton control—preselection of 18 feeds and 36 speeds.
- An excellent machine for drilling, boring, reaming, tapping and milling as well as precision measuring.
- Optical system has a magnification of 1:100—five inches on the focusing screen is equivalent to a movement of 0.05 inches along the coordinate.
- Working surface of table 69x39″, clearance between columns 73″, maximum distance between spindle and table 40″.

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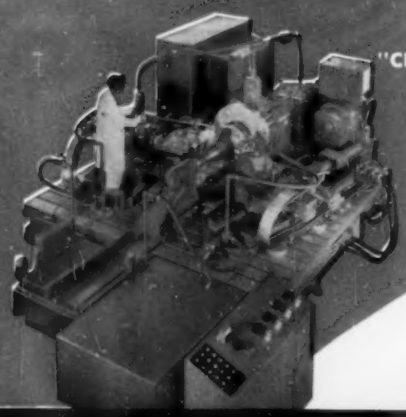
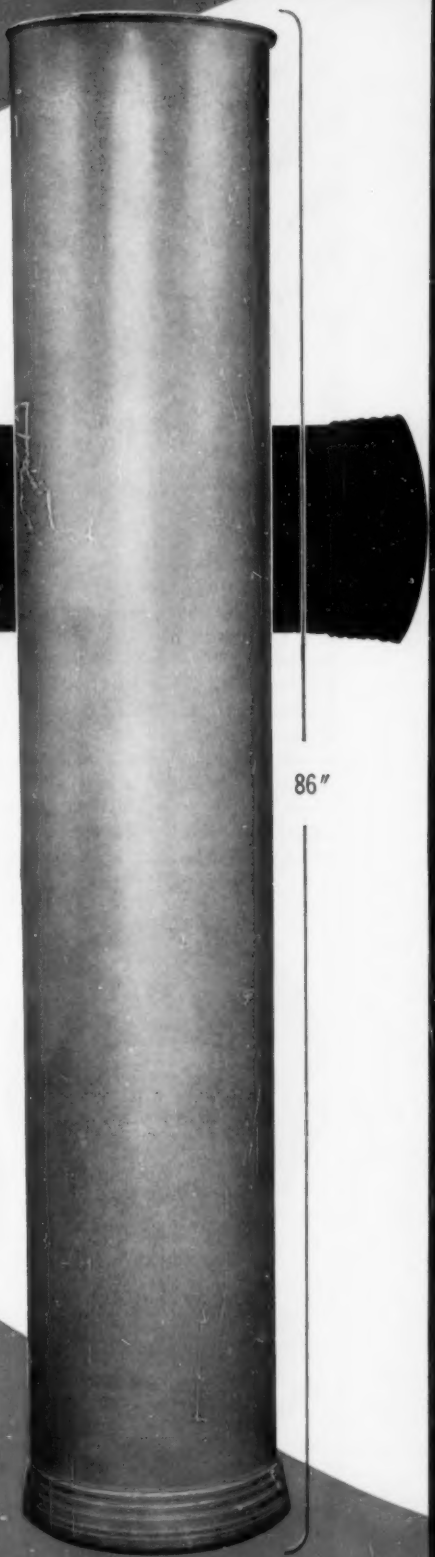


"CHIPLESS MACHINING"
Cincinnati 42" x 30"
Duplex Hydrospin

THE CINCINNATI

Hydrospin

roll-flows this 11" blank . . .



into this 86" seamless steel tube

JOB DATA: The blank is a billet-pierced, ring-rolled forging of annealed AISI 4140 aircraft quality steel, machined to 11" long x 13½" I.D. x ½" thick. The ring, slipped onto a straight, hardened mandrel, was *roll-formed* to the desired dimensions in less than 25 minutes (floor to floor time). "*Chipless machining*" by the Cincinnati Hydrospin reduced the wall thickness 92%. The finished tube is 86" long x 13.500" I.D. x 0.040" thick. Hardness increased to Rockwell C 39. Tensile strength after Hydrospinning is doubled. I.D. finish is 10 micro-inches and O.D. finish is 30 micro-inches or better.

HYDROSPINNING is the first economical method available for producing precision, thin-wall seamless tubing. Let a Cincinnati Milling field engineer give you detailed information. For a description of the Hydrospinning process and machine specifications, write for Bulletin M-1873-1.

CINCINNATI **Hydrospin**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

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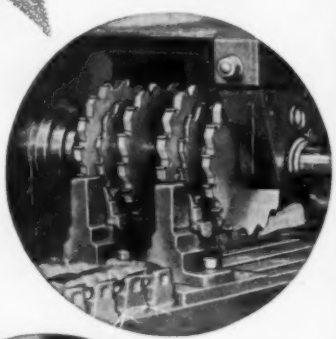

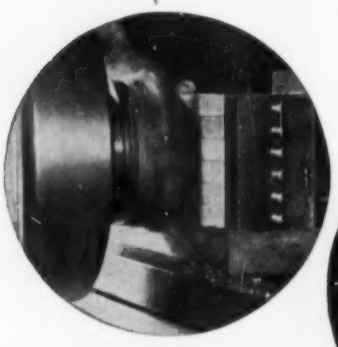

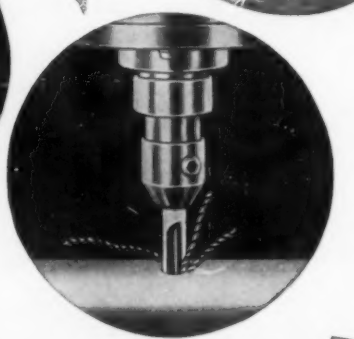

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4 FLUTE DOUBLE END SOLID CARBIDE END MILLS
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2 FLUTE SOLID CARBIDE END MILLS
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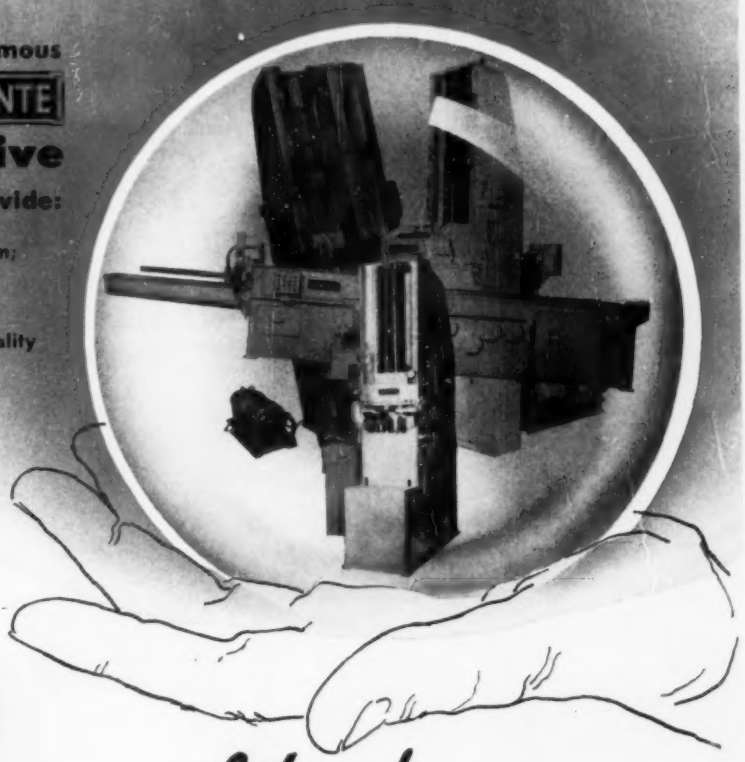

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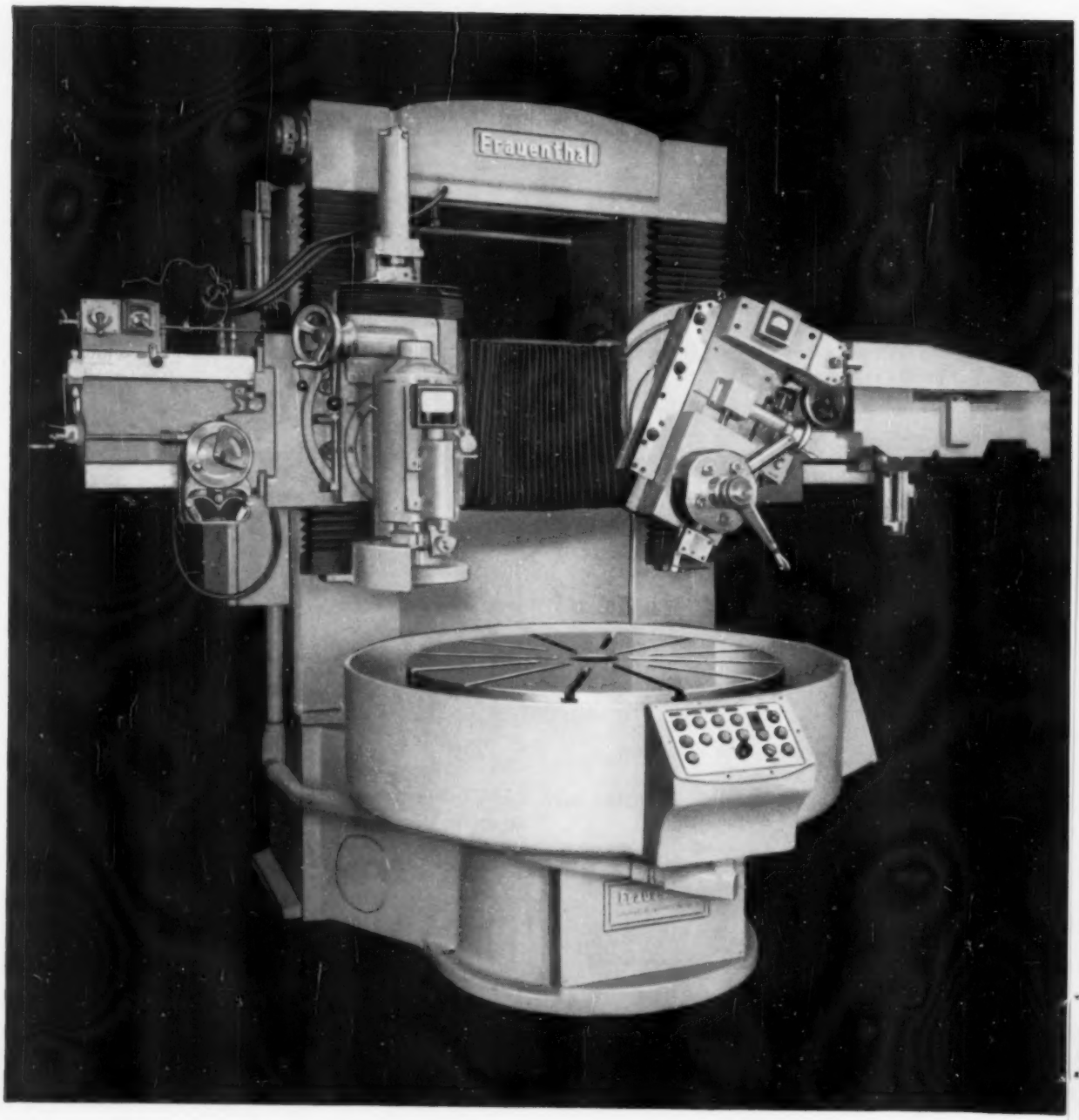

turn, bore and grind in a single set-up?

The Frauenthal 3100 Series offers this precision and versatility with these cost-cutting features

1. Utmost versatility — Both grinding compound and turret slide can be swiveled to meet practically any angular requirement.

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3. Horizontal table — Loads easier and faster than vertical face plates. Horizontal table also provides greater stability for large, heavy parts.

4. Simplified tooling — Horizontal table permits simpler fixtures, particularly for thin-section jet engine parts, plus economy of dual purpose tooling for turning and grinding.

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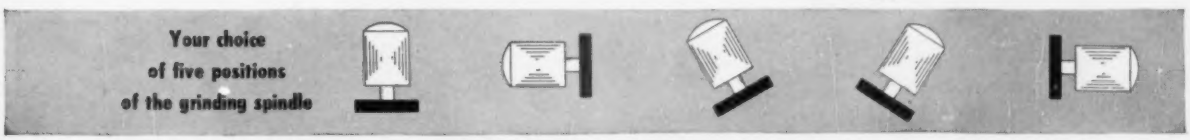
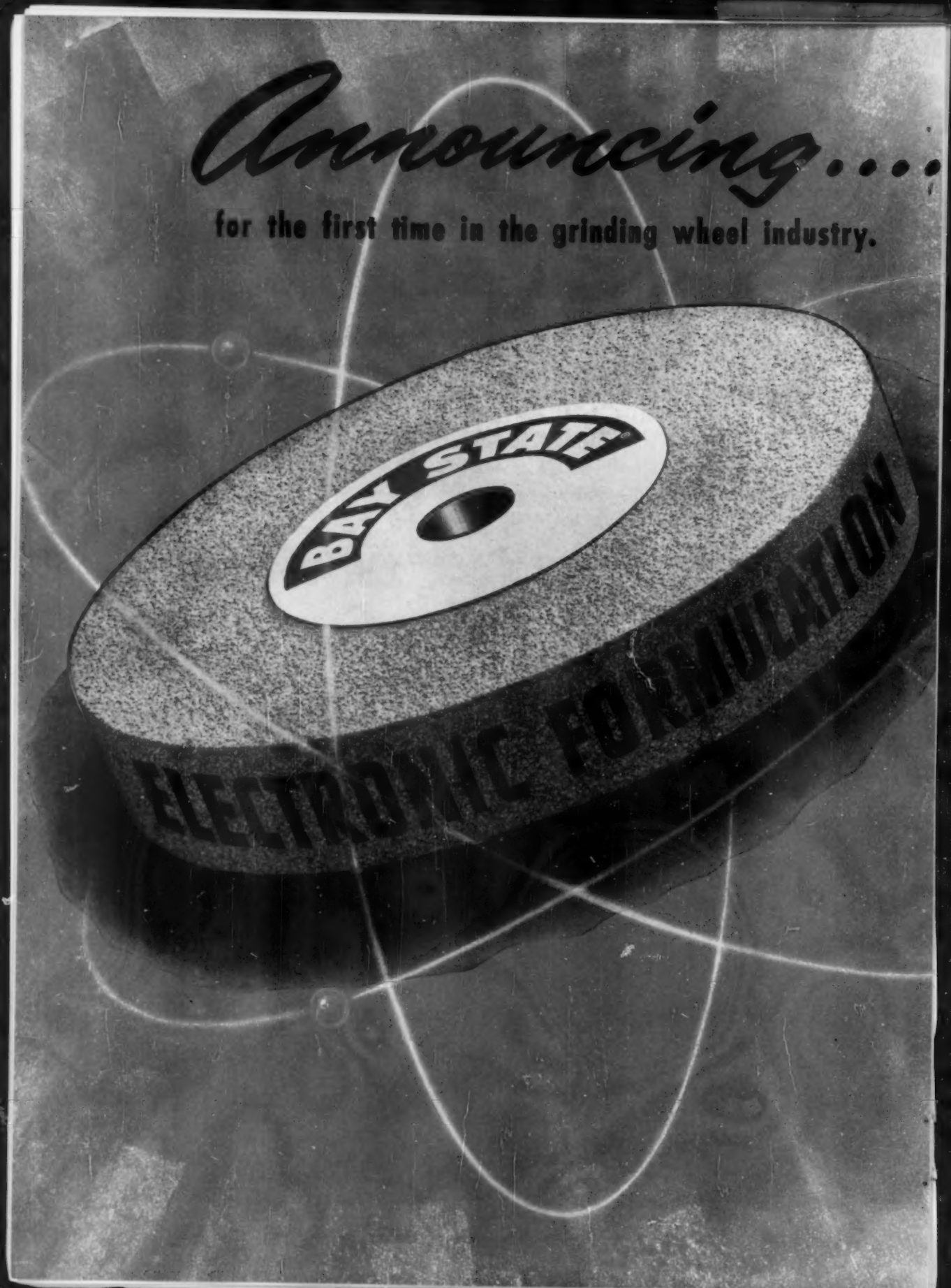
6. Contour turning — Hydraulic duplicator attachment (turning head) performs tracer controlled turning operations most accurately and performs repetitive operations at lower cost.

May we help you?

If you'd like further information on how the 3100 Series precision turning and grinding machine can give you production and/or tool room advantages — our engineers are at your service. Write for informative bulletin No. 301.



Frauenthal Division · KAYDON ENGINEERING CORP. · Muskegon, Michigan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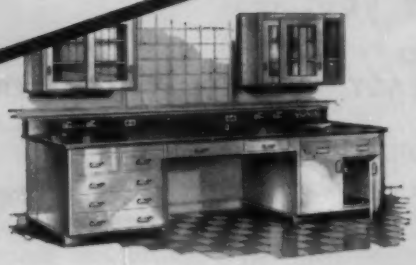

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Cincinnati Shears accurately cut various thicknesses of material, without a change in knife clearance—this is a profitable time saver.

Photos courtesy the Hamilton Mfg. Company, Two Rivers, Wisconsin.

New front controlled power back gauges are now standard equipment on ALL CINCINNATI SHEARS.

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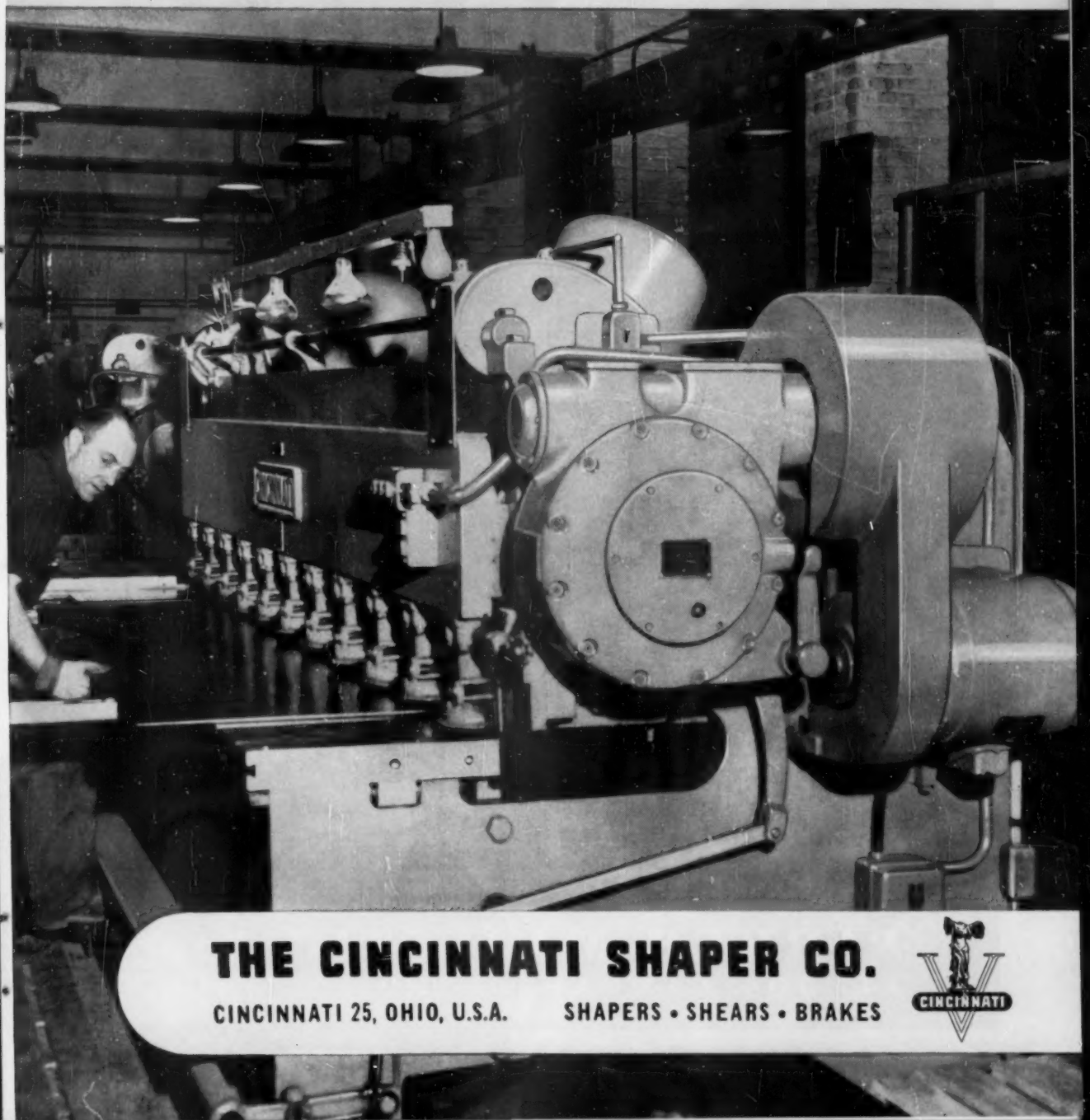

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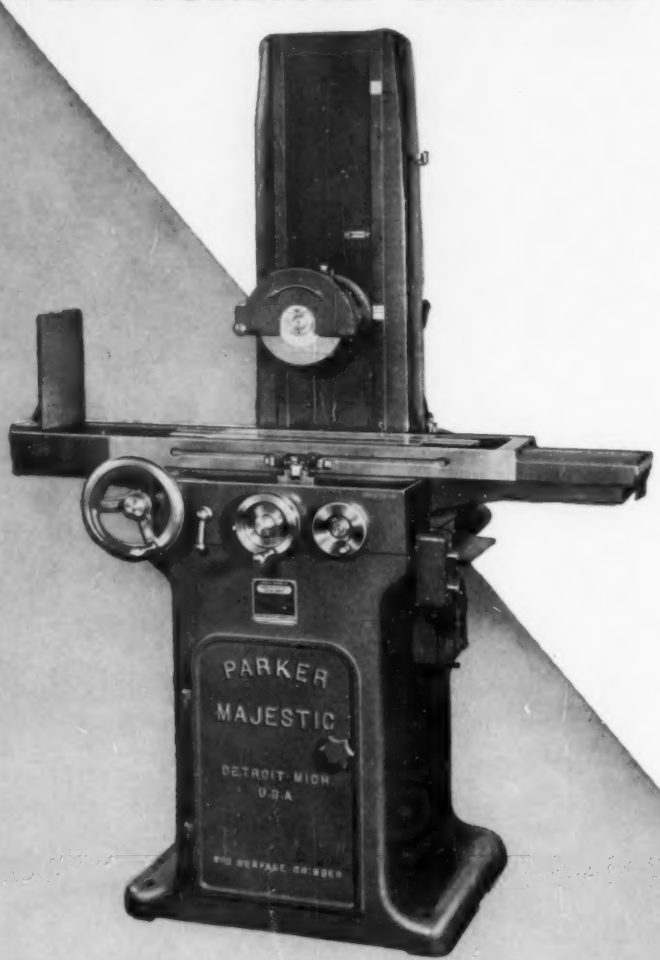

Elevating hand wheel mounted in saddle.
Motorized drive for rapid spindle elevation.
Handwheel graduated directly in .0001″ increments.

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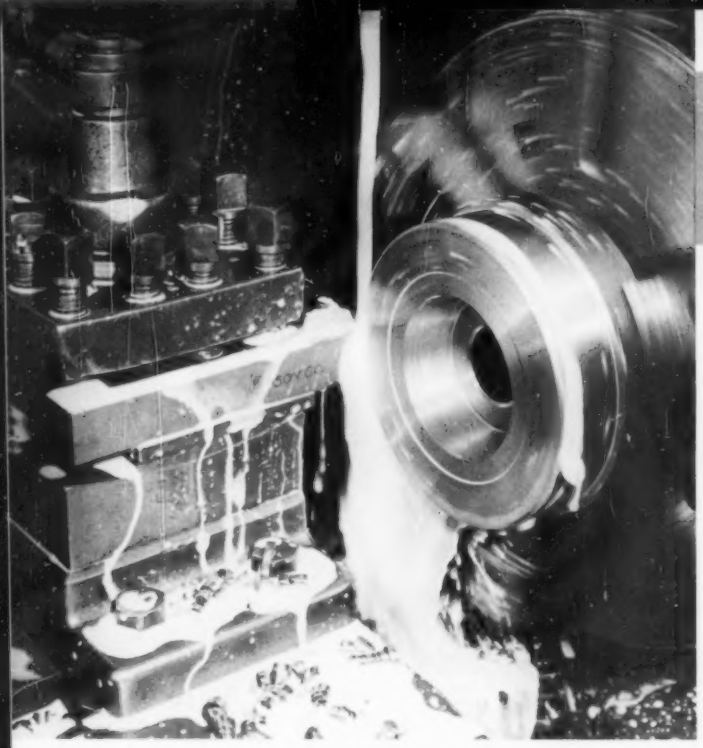


carbide NEWS

With volume way up WESSON cuts prices up to 42%

Big Swing to "No Grind" Inserts Cuts Holder Prices

So big has been the demand for Wesson Multicut no grind carbide insert holders that price cuts up to 42% have been made possible without sacrificing a single one of the premium features that has made these holders the recognized quality leaders in the field. The cuts average 32 per cent with reductions on individual holders ranging from 23.8 to 42 per cent. Of interest is that the cuts come at a time when almost all items made of steel are going up in price.

Industry's overwhelming acceptance of these premium-feature holders has enabled Wesson to adopt large volume manufacturing methods with resulting major savings. "By passing on these manufacturing savings to our customers, we expect a still further expansion in applications," says W. B. Duncan, Wesson's board chairman.

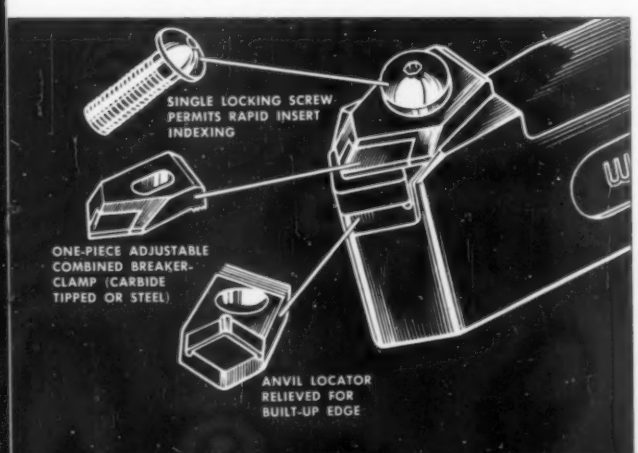
Six different basic styles of holders are standard in the Multicut no grind series with a total of 39 sizes available. These holders which allow quick indexing of the insert to present a new, sharp cutting edge and thus do away entirely with tool grinding are already being used on thousands of turning operations including internal boring and chamfering, straight and vertical turning, internal and parallel facing, etc.

All Premium Features Retained

Every feature which has made these Wesson tool holders the leaders in the no grind carbide insert field has been retained in making the price cuts. These include Wessons' exclusive one-piece clamp-breaker construction, adjustable chipbreakers and precision cast anvil-locators with relieved seats to clear built up edges when indexing. The single-screw lock for the chipbreaker allows indexing without dislodging the chipbreaker — particularly important feature when indexing holders used in upside down or similar positions. Clearance angles of holders are also larger than usual, permitting application on more types of jobs including internal operations.

The holders eliminate all tool re-grinding, reduce inventory of special holder parts, and greatly reduce down-

(continued on page 2)


SINGLE LOCKING SCREW PERMITS RAPID INSERT INDEXING
ONE-PIECE ADJUSTABLE COMBINED BREAKER-CLAMP (CARBIDE TIPPED OR STEEL)
ANVIL LOCATOR RELIEVED FOR BUILT-UP EDGE

Sketch of one of the Multicut holders for no grind inserts showing some of the premium features

Big Swing To "No Grind" Inserts

(continued from page 1)

time for tool changes. Setup time is also less.

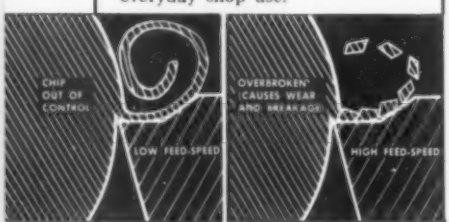
Complete details of the Multicut series for no grind inserts are contained in the reprint "New Trend in Carbide Tooling" and in illustrated bulletin No. 5510-M. Both are available from Wesson. The holders will be the "ASTE Blue Ribbon" feature in Wesson's Booth #450 at the Tool Show in Chicago, in March.

New Breaker Guide is Industry First

Industry's first comprehensive guide to mechanical chip-breakers for no grind inserts will be issued shortly by Wesson Company. The company's Research Division is now analyzing the results of a broad range of laboratory and practical shop tests.

"This new guide, we believe, will be highly useful to every size shop now doing or planning to do machining with 'throw-away' insert tooling," says W. B. Bader, research division head.

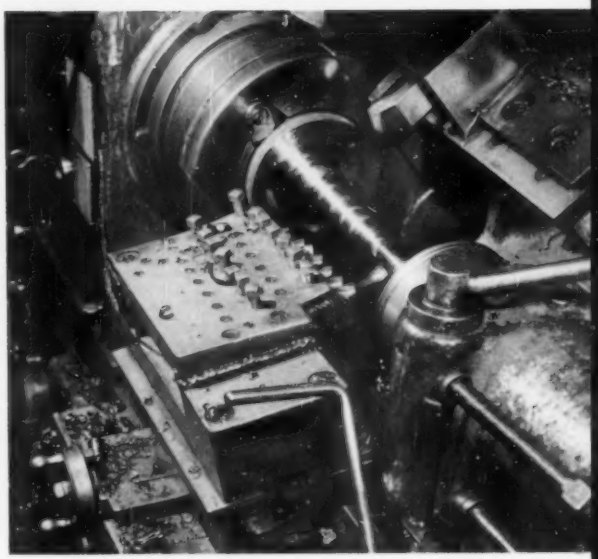
The new guide will reveal the ACTUAL effective range for specific chip breaker dimensions at various speeds and feeds. To obtain the basic data, tests have been conducted on all of the most commonly used steels. Test findings and recommendations are being illustrated and simplified for everyday shop use.



Wesson's new guide will tell how to avoid conditions like these with insert tools

Copies of the forthcoming guide may be reserved now by writing to Wesson Company, Dept. AD, 1220 Woodward Heights Boulevard, Detroit 20, Michigan. Ask for "New Chip Breaker Guide." Copies will be mailed immediately after printing to all advance requests.

Tool Costs Tumble from 9¢ to 2¢ per Piece With Wessonmetal "26"



Eight "26" brazed flat tools and one Multicut insert holder cut tool cost of rough turning and facing alloy steel stem gear

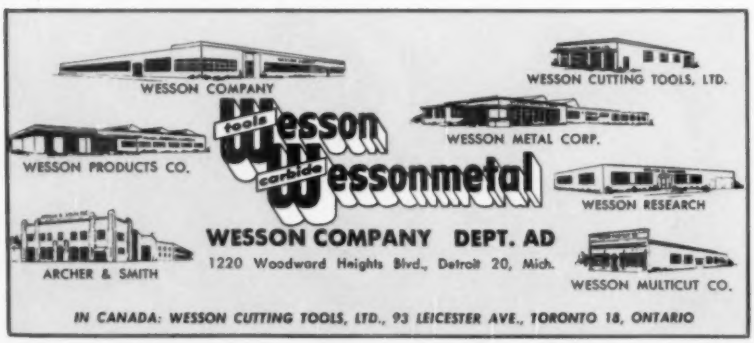
Significantly lower tool costs and a nearly doubled production rate were results of a switch to Wessonmetal "26" carbide in a large eastern gear manufacturing plant. The comparison was with several steel cutting types and grades previously used.

The operation consists of facing and rough turning 32 Rockwell C alloy steel stem gears on a 20-in. Fay automatic lathe. The multiple tool setup used eight Wesson brazed-type flat tools tipped with grade "26" and one Multicut holder.

Formerly, the job was done at 525 rpm and 270 sfpm but it was found possible to boost this to 580 rpm and 305 sfpm with Wessonmetal "26" while getting far better tool life. Depth of cut now averages 3/16-in. As a result, one-fourth of the machining time has been chopped off (now 1½ minutes). This, plus the lower down time for tool change with longer tool life has nearly doubled hourly production (from 30 pieces per hour to 50).

Savings with Wessonmetal "26" came from 4 sources: (1) The larger number of grinds possible (9 to 10 vs. 4) due to reduction in edge wear and breakage, (2) more than doubling the pieces per grind, (3) fewer tool changes required, and (4) higher output per hour.

Pieces per grind with Wessonmetal "26" ranged from 125 to 175. This compares with 60 to 70 per grind with other carbides. However, grade 26 tools only showed a normal .014 wear after 175 pieces as against far greater stock removal per grind previously. Total pieces per tool ranged up to 1400 for Wessonmetal "26" as against an average of 280 formerly.



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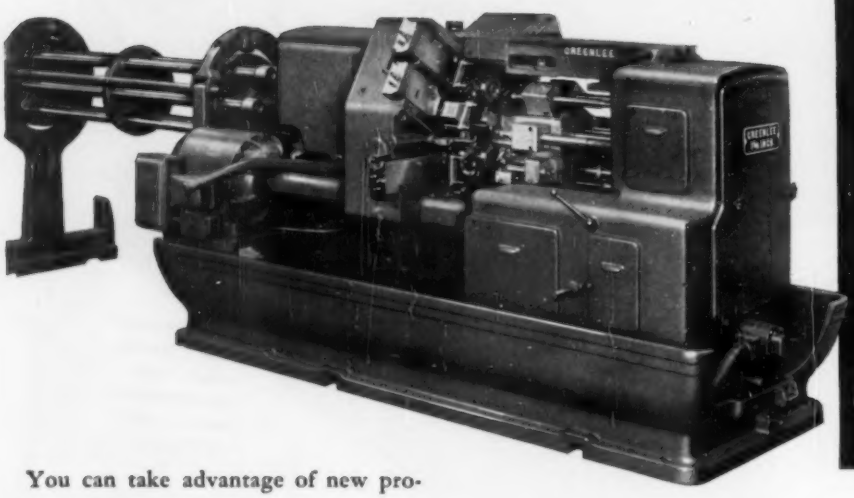

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You can take advantage of new production techniques...attain higher levels of efficiency with the improved Greenlee 6-Spindle Bar Automatic. Its advanced design opens the door to some real profit opportunities. • These design improvements are fully described in a catalog recently issued. Let us send you a copy today. Find out how Greenlee Automatics can save time and money in your plant. It will pay you to investigate.

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The spindle has been completely redesigned to assure greater accuracy at higher speeds. True running... the new Greenlee spindle has five widely spaced, preloaded, angular-contact, precision ball bearings. Entire spindle is dynamically balanced for smooth operation. Metallic seals, labyrinth and friction washers with line contact provide maximum heat dissipation.

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Rockford, Illinois

Pull...like a bull elephant

OK DUAL ADJUSTMENT milling cutters, size for size, are the huskiest produced. In simplicity lies their great strength. There are just two parts — body and blades . . . uncomplicated or weakened by cut-outs or recesses for locks, pins, gibs or gadgets. Bodies are drop-forged, with slots positioned to micrometer dimensions. Blades are available in high speed, alloys or carbide.

The drive-fit insures a secure seat. Mating serrations prevent blade movement except for advancement to compensate for wear. This simple construction permits the use of more blades in the fine pitch series and heavier blades in the coarse pitch series. OK cutters convert the full horsepower available without losing a kick, remove the maximum amount of metal — measured in speed, feed, chips, minutes, power consumption or man hours. **Do you have a copy of the OK catalog 13?**

OK

modern milling cutters for modern milling machines

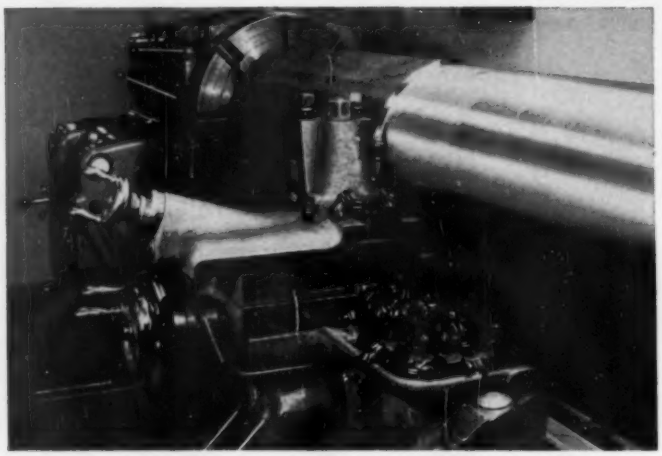
THE OK TOOL COMPANY, Inc., Milford, New Hampshire

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-41

NEW... ALL NEW!

FIRTHITE TXH

A heavy-duty, general purpose premium Carbide at no premium price



OUTSTANDING FEATURES OF TXH

- Higher hardness to strength ratio.
- Improved impact resistance.
- Wider range of applications.
- Cooler operating temperatures.
- Higher edge strength.
- Greater resistance to abrasion.

TXH is new, brand new, not just another grade designation for an altered existing grade. It is a completely new concept . . . a combination of materials and processes designed specifically to do heavy duty, high production cutting operations better than they have ever been done before. It does.

During development in Firth Sterling laboratories, FIRTHITE TXH *out-performed* and *outlasted* all other *premium grades of carbide.* After thorough introduction in the field, performance has exceeded laboratory predictions in case after case.

Here is a premium quality carbide developed for an age of automation which, at no extra cost, out-performs and outlasts all others.

Available from stock now in all standard tips and tools. Try it *now* and *prove it yourself!*

FOR ENGINEERING SERVICE CALL YOUR NEAREST FIRTH STERLING REPRESENTATIVE

R-314

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High Temperature Cermets
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CALL YOUR FIRTH STERLING DISTRICT OFFICE OR DISTRIBUTOR. ASK MR. TOOLEY.

ANOTHER EXAMPLE of
REDUCING COSTS WITH—

Buhr ECONOMATION

Drills, chamfers, spot-faces and individual-lead-screw taps 377 master-brake cylinders an hour gross....

and features electronic mechanism for checking broken drills!

This 7-way dial-type hydraulic-feed Buhr Special has a 48″-diameter 7-position power-operated index table, complete with shot bolt. Two parts are loaded per station in each of its seven fixtures. Automatic clamping of fixtures is performed by a power-wrench with torque control.

Electronic mechanism automatically checks two .028 drills. Following each cycle, drill-checking arms swing sensing probes to and from drills. If either drill is broken, special electronic sensing-circuit stops machine and flashes failure-light.

Buhr
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

Find out how Buhr Economation can reduce your production costs. Phone, wire or write us. A consultation with one of our top sales executives will be arranged promptly!

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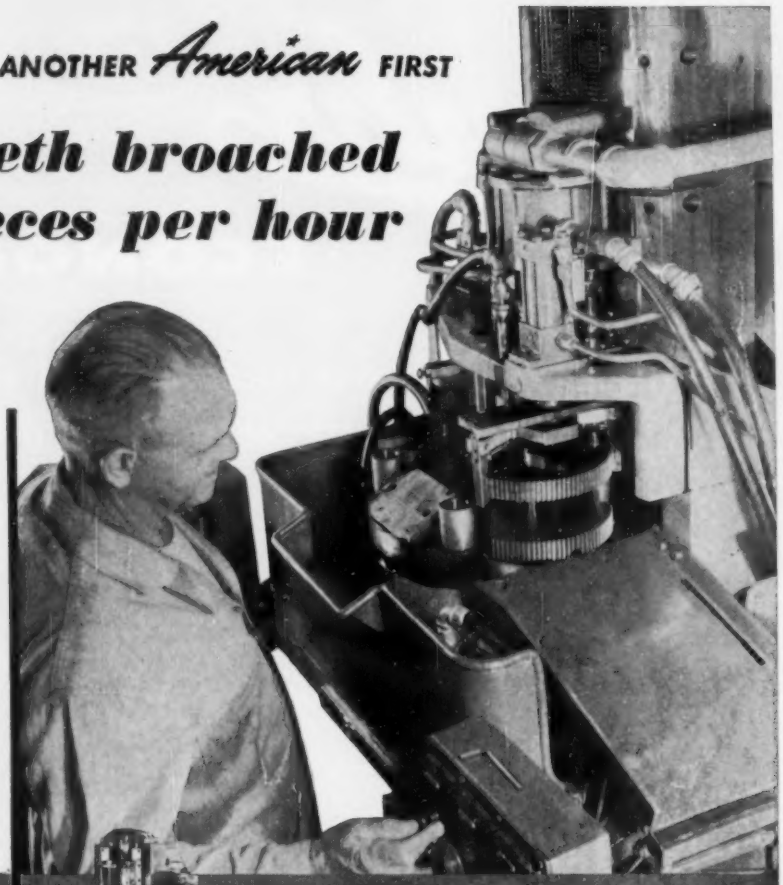
ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

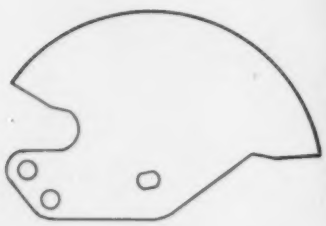
ANOTHER *American* FIRST

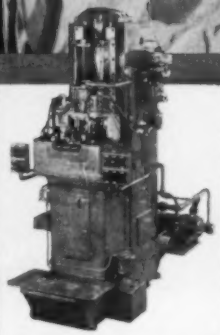
Involute teeth broached in 1200 pieces per hour

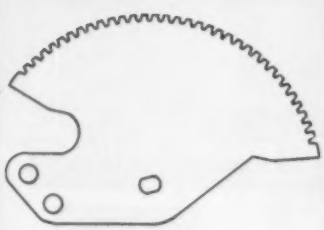
. . . 10 PARTS AT A TIME!



Part before broaching







With involute teeth broached

An indexing fixture, equipped with two loading stations and automatic clamping, is mounted on an American 3-way machine to perform this specialized high production broaching operation. While one station is broaching, the operator stacks 10 parts at the other station. The stack is automatically indexed into broaching position and then clamped. At end of the broaching stroke, the stack is indexed and discharged into a chute by an automatic air ejection unit.

The low piece cost obtained on this machine, is an example of the economies that American gives you — by supplying a machine completely tooled with work-holding fixtures and broaches.

Why not put American to work on *your* broaching problem. A parts print or sample will receive prompt attention. Or write for catalog 450. It is an informative manual on all phases of broaching.

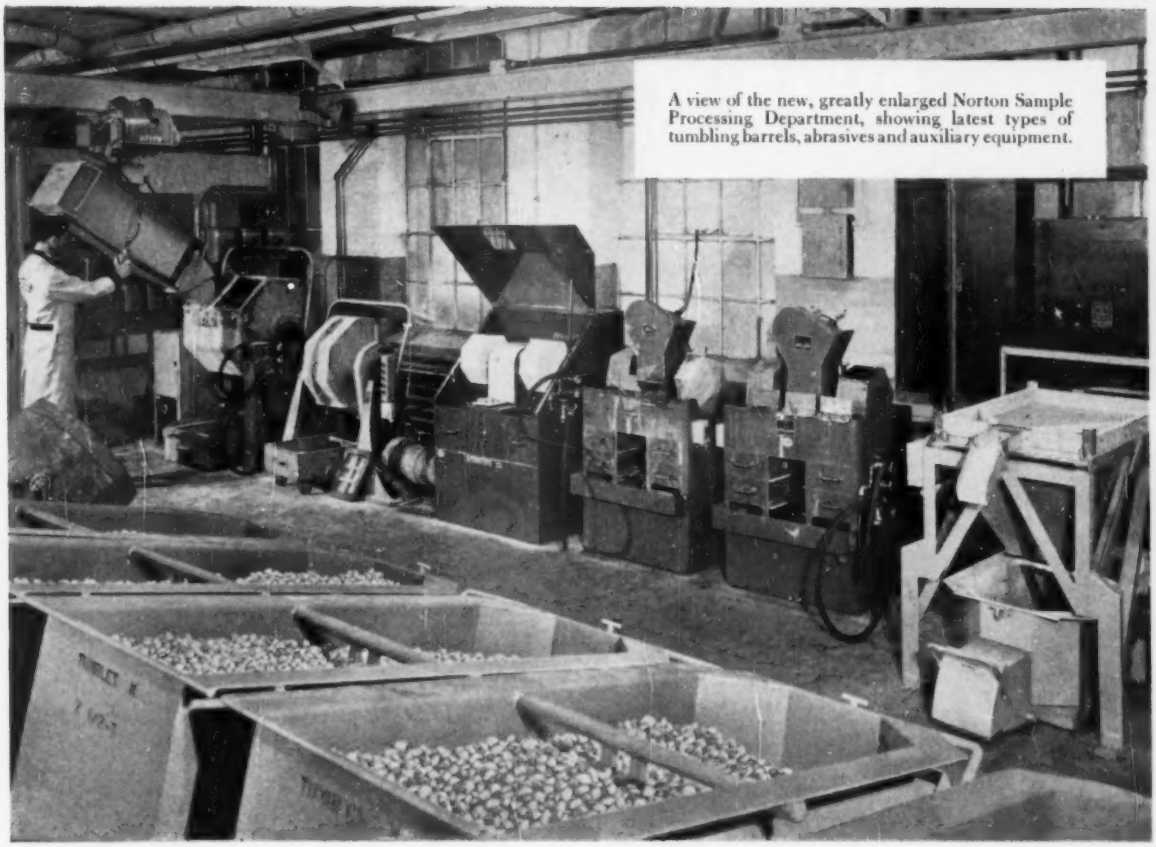
AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



A view of the new, greatly enlarged Norton Sample Processing Department, showing latest types of tumbling barrels, abrasives and auxiliary equipment.

Find out what barrel-finishing can do for you

Make the Norton Sample Processing Department your proving ground for faster, lower cost production methods

If you're still finishing metal parts the long, hard, expensive way — with out-of-date tumbling or off-hand methods — here's your chance to find out how you can improve product quality and cut production time and costs.

The newly enlarged Norton Sample Processing Department puts at your disposal the very latest advances in barrel finishing — including equipment, abrasives and techniques.

Perhaps you'd like to speed up your deburring or descaling operations. You may have complicated parts. You may want to get a better color on your finish, or a lighter cut on die castings so as not to cut under the smooth outside surface.

Whatever your finishing problems, just send us sample parts — and they can range from tiny needles to hefty forgings. Without charge or obligation Norton production engineers will find out just what tumbling will do for you. Your finished parts will be returned along with a detailed report telling you exactly how to get best results from tumbling in your plant. This includes recommendations as to barrel type, size, speed and time cycles . . . type, size and amount of abrasive media to use . . . proportion of compound or cleaner to water, and other data.

What To Send Us

Along with your unfinished parts please forward: (a) a finished sample to be matched (hand-finished if necessary); plus (b) information on your present barrel finishing equipment, if any, including type and size of barrel and speeds. Address the Sales Engineering Department, Abrasive Division, NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

G-300

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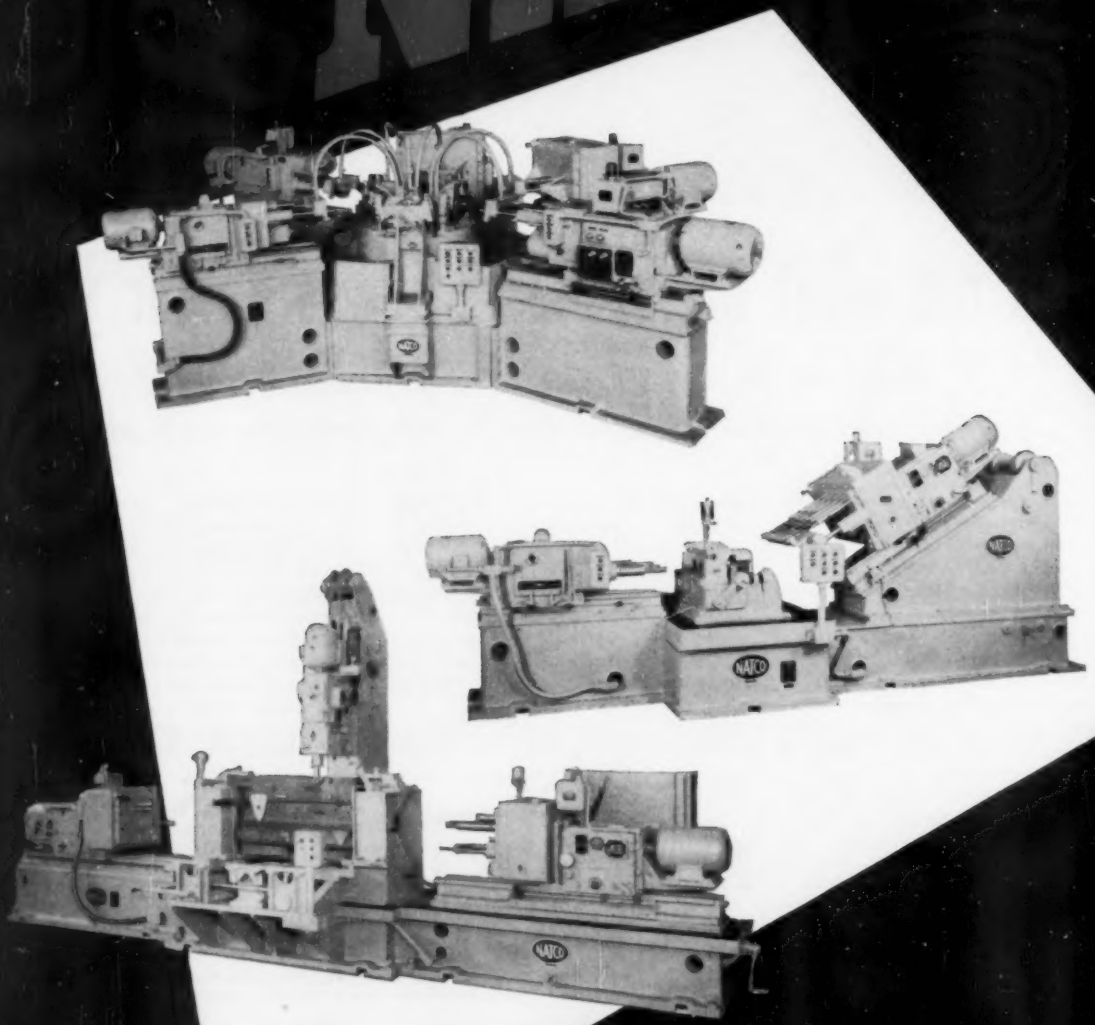
Making better products... to make your products better

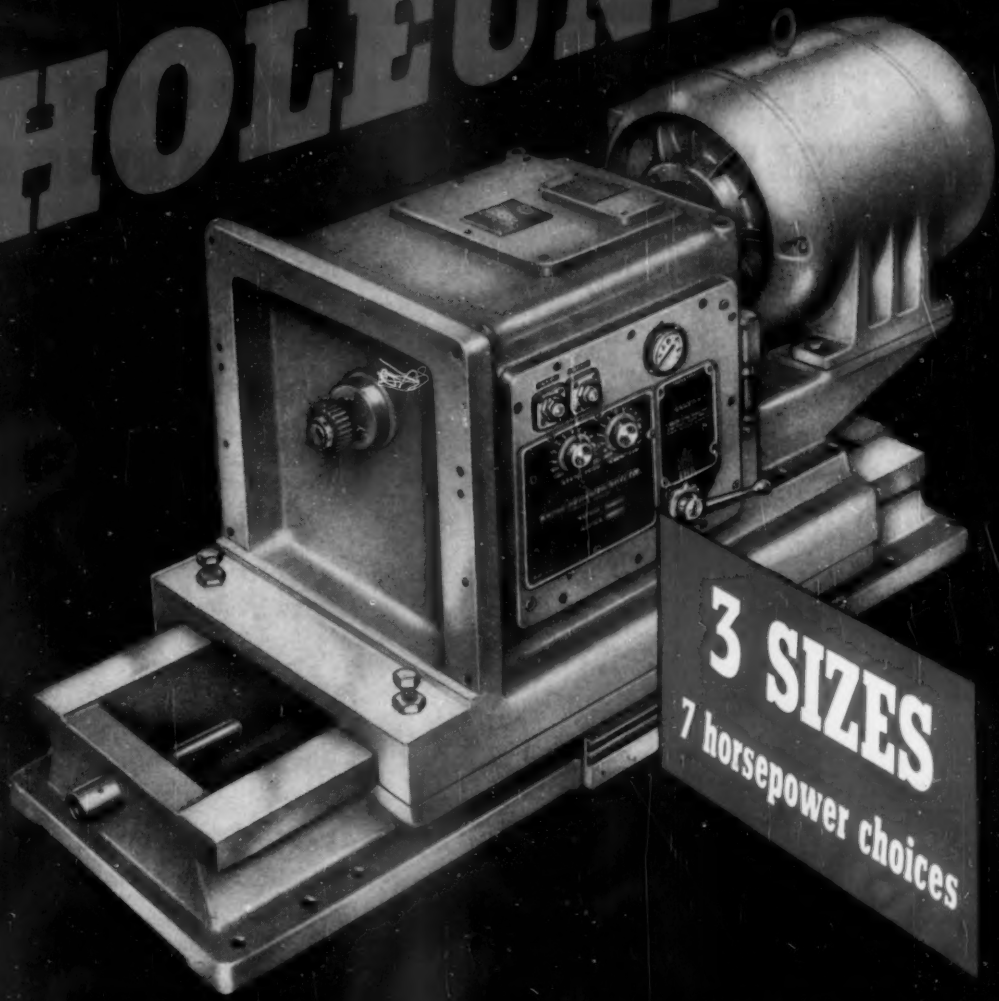
NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

BUILD YOUR OWN DRILLING, BORING, FACING and TAPPING MACHINES WITH...

NATCO



HOLEUNITS



Shown at left are a few representative machines that have been built from NATCO Holeunits. These standard, compact, self-contained hydraulic units are furnished in three sizes and may be arranged with any one of seven different horsepower capacities ranging from one and one-half to fifteen horsepower. They will operate at any angle and no connections other than electrical are required.

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

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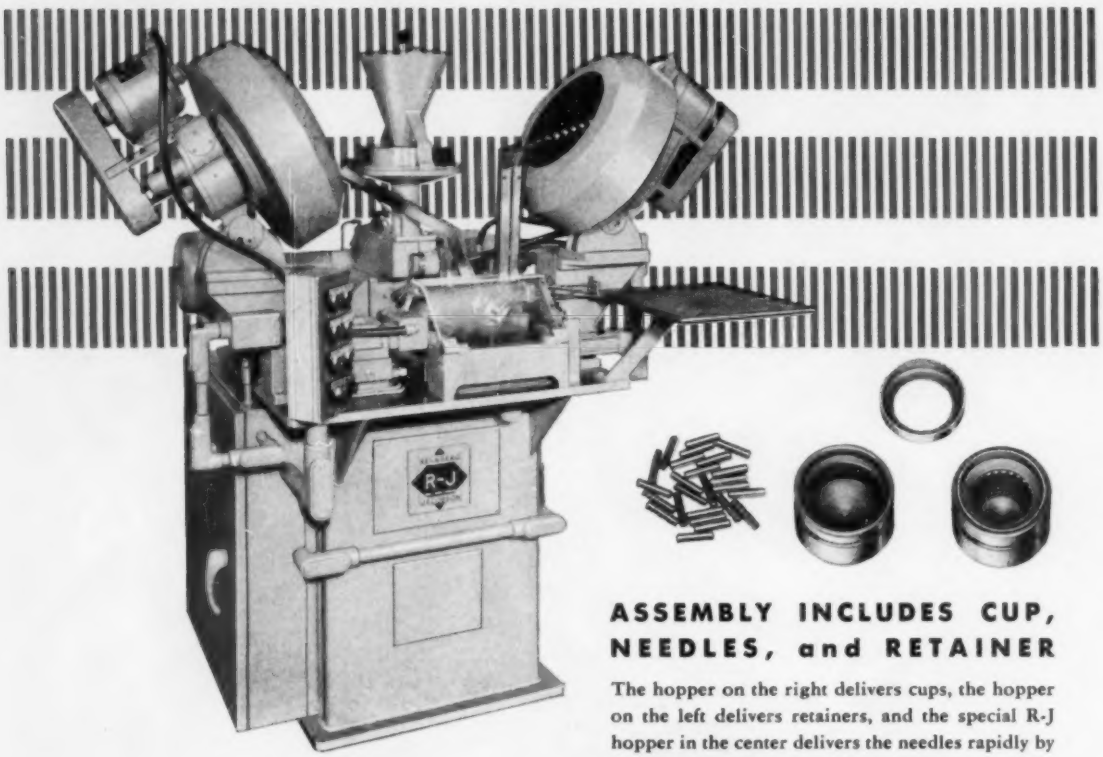
Rehnberg-Jacobson

FULLY-AUTOMATIC MACHINE ASSEMBLES NEEDLE BEARINGS



25 YEARS OF EXPERIENCE

This machine, which is used to assemble bearings for the "cross" of a universal joint employed in a well-known automobile, represents another climax in the long and successful history of the design and manufacture of Needle Bearing Assembly Machines by Rehnberg-Jacobson. Much specialized knowledge and many unique and ingenious mechanical devices go into the development of such a machine. Rehnberg-Jacobson has made a specialty of producing highly successful and economical machines of this nature for twenty-five years. We *are prepared to quote on your needs.*

ASSEMBLY INCLUDES CUP, NEEDLES, and RETAINER

The hopper on the right delivers cups, the hopper on the left delivers retainers, and the special R-J hopper in the center delivers the needles rapidly by centrifugal action. After the cup is automatically greased, the needles are projected into it, and a retainer is pressed in to hold them. Then the assembly is delivered, open side up, to the tray. The cup and retainer hoppers employ gravity and a balancing edge to insure that all parts delivered to the chutes are facing properly for assembly. Assembly and delivery actions are operated hydraulically. *Capacity is 900 assemblies per hour,* or more. All that is required of the operator is to keep the hoppers loaded and remove the filled trays.

Designers and Builders of Special Machinery

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ROCKFORD, ILLINOIS

FASTER SAFER HANDLING

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SUPERIOR PRECISION ALL STEEL DIE SETS

Large Sets No Longer Need Be Blocked . . . Small Sets Can Be Lifted Without Sliding.

Three features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment. Write for FREE 24 page Catalog on Superior Die Sets and Supplies.

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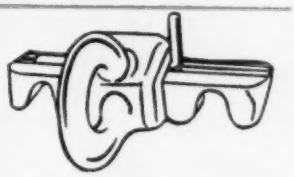
SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

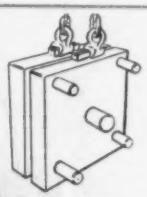
SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. There is no extra charge for this valuable safety feature.



LOCK-JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set. They are positioned to insure proper balance when the set is lifted by either chain fall or crane.



E-Z LIFT SLING CHAIN

is especially designed to fit the flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs.

Up to 40% higher tightening torques — a feature of new High-Torque Unbrako socket set screws

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES
(Inch-Pounds)

SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

Compare UNBRAKO-recommended tightening torques with those of ordinary socket set screws and you readily see why you can set an UNBRAKO and then forget it. The reasons are simple. UNBRAKOS have deeper sockets, which give you better purchase with the wrench; rounded socket corners, which eliminate the sharp corners where cracks start; fully formed threads, which make them stronger; and knurled cup points, which keep them tight.

Let's see just how the development of fully formed threads make the new High-Torque UNBRAKO stronger. The metal is compressed into the closely knit grain structure that you see in the illustration. The grain flow follows the contour of the threads. There are no straight lines along which shear can occur. An UNBRAKO retains its flow lines even when ground down to .010" below root diameter. Conversely, cut or ground threads have straight flow lines—lose thread form at root diameter.

You can't buy a better screw than an UNBRAKO. And you can't get full *high-torque* performance without a "High-Titan" UNBRAKO Hex Key—the high-ductility, precision internal wrenching tool. See your authorized distributor today. Or write STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

STANDARD PRESSED STEEL CO.
UNBRAKO® SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

UNBRAKO SET SCREW THREADS

ORDINARY SET SCREW THREADS

the POWER you need in ⅓ less space . . .

O-M

CYLINDERS

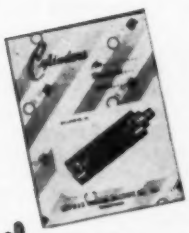
TIE ROD-LESS

- *air and hydraulic*
- *meet JIC standards*

O-M's special interlocking mechanism strips unnecessary bulk, does away with tie rods and out-sized end caps . . . saves up to ⅓ the installation space required by conventional-type cylinders of the same bore.

This internal locking feature means less maintenance, too, O-M cylinders are easier to clean, inspect, remove, disassemble and service, with no alignment problems in re-assembly.

Available in complete range of sizes (1½ to 8" bores), with standard, 2 to 1 or oversize rods. All steel construction with bearing bronze. Completely interchangeable parts. Immediate delivery on many sizes.



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for FREE catalog, showing all cylinders, mounts and mounting brackets.

ORTMAN-MILLER MACHINE COMPANY

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☐ Have representative call ☐ Send latest catalog

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CUSTOMER SPECIFIED
Color indicates machined surfaces
A leading automotive manufacturer recently specified a multi-purpose production machine to perform a combination of rough and finish milling, horizontal and vertical drilling operations. Specifications called for a single machine that would do all these operations with increased efficiency and lower production costs.
Feed Slide Unit
Quill Feed Unit
Lead Screw Tapping Unit
Way-Type Drill Unit
Rotary Index Table

Kearney & Trecker offers you standard

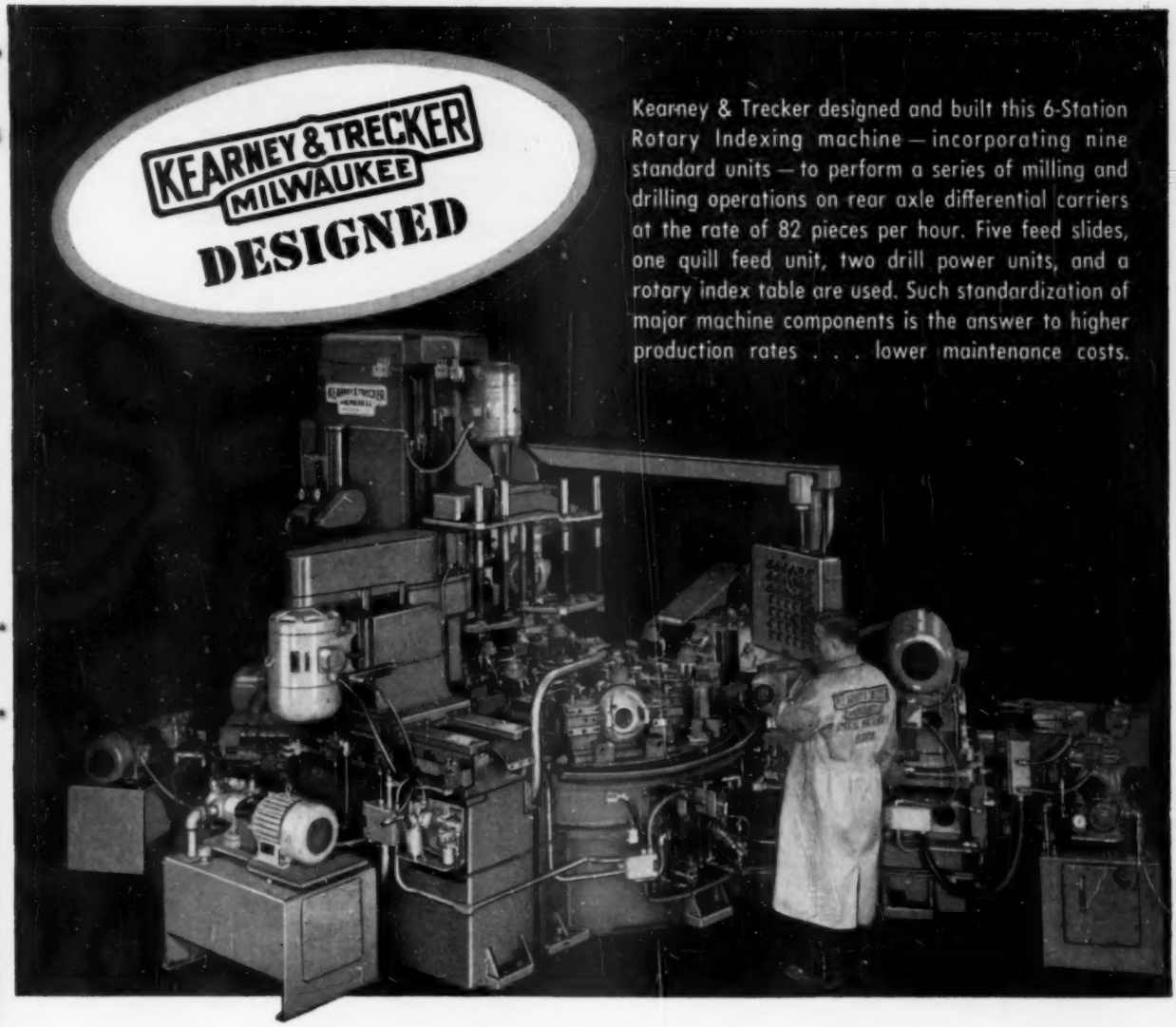
Illustrated here are several standard units which Kearney & Trecker incorporates in automatic production machines that perform a combination or series of drilling, milling, boring and tapping operations to exacting accuracies.

Kearney & Trecker combines these standard design units with a minimum of special engineering to keep production machine costs at a minimum. What's more, you get increased production at lower cost and higher efficiency. Such utilization of standard units provides the economies you want, from job-proven designs with minimum of capital investment.

Standard Feed Slide Unit — One of the most important developments, the Model B Feed Slide provides hydraulic feed for milling, boring or drilling heads. Available in four sizes (determined by width of ways), and each size in four different length cylinder strokes. A variety of feed cycles is possible — single, fine and coarse, single skip, double skip and feed return. (Data Sheet No. 1019a.)

Standard Quill Feed Unit — Simplifies and speeds production of machines which perform drilling, boring, reaming, counterboring and chamfering operations. There's 10" stroke and a spindle speed range of 200-1690 rpm, which is variable by change gears and sheave diameters. Single or multi-spindle arrangements are possible as well as single or double feed rates. (Data Sheet No. 1055.)

Standard Rotary Index Table — Designed especially for production machines, the Rotary Index Table is a rugged, accurate, self-contained unit for mounting various work-holding fixtures. Unit is available in four



Kearney & Trecker designed and built this 6-Station Rotary Indexing machine — incorporating nine standard units — to perform a series of milling and drilling operations on rear axle differential carriers at the rate of 82 pieces per hour. Five feed slides, one quill feed unit, two drill power units, and a rotary index table are used. Such standardization of major machine components is the answer to higher production rates . . . lower maintenance costs.

units for lower production machine costs

different table diameters — 36″, 48″, 60″ and 80″. (Data Sheet No. 1018a.)

Standard Way-Type Drill Unit — Designed for drilling, boring, reaming, counterboring and chamfering operations with heavy cutting loads. Entire unit can be mounted at any angle on a production machine. Single or multiple-spindle arrangements as well as single or double feed rates are possible. Completely self-contained spindle head has a speed range of 98-1691 rpm, with 72 increments . . . feed range of 1-16 ipm . . . 140 ipm rapid advance and 260 ipm rapid return. (Data Sheet No. 1075.)

Standard Tapping Unit — This compact, self-contained unit can be arranged to tap any thread from ¼″ to 1″ in diameter in both national coarse and fine series, in addition to six sizes of pipe taps. Spindle speeds range from 80-280 rpm with a choice of three motors, 1, 2 or 3 hp. Single as well as multi-spindle arrangements are possible. (Data Sheet No. 1074.)

For more complete information on standard units, ask for Data Sheets listed under each unit; for details on the 6-Station Rotary Indexing machine, utilizing nine standard components, request Data Sheet No. 1076. See our nearest representative, or write Kearney and Trecker Corp.

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MILWAUKEE
MACHINE TOOLS

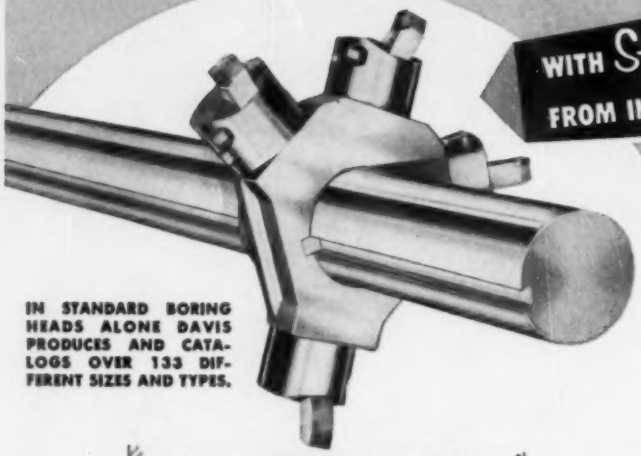
Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

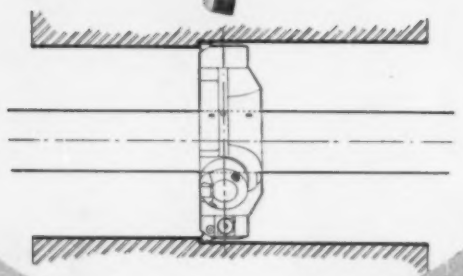
Builders of Precision and Production Machine Tools Since 1898

Let DAVIS cut your Boring Costs 2 ways

WITH Standard Tooling ITEMS FROM INDUSTRY'S MOST COMPLETE LINE



IN STANDARD BORING HEADS ALONE DAVIS PRODUCES AND CATALOGS OVER 133 DIFFERENT SIZES AND TYPES.



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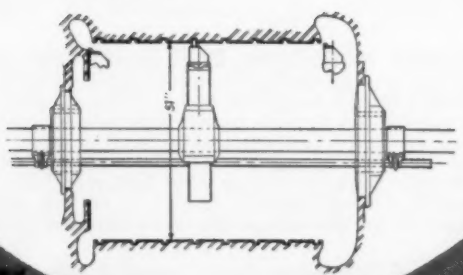
Where work is beyond the scope of standard tools or where efficiency can be improved or costs reduced by combined operations, special fixturing, etc., the specialists in Davis Engineered Tooling Service will work with you in developing tools for even the most complex application. Consult your local Davis field engineer or send us complete work details for impartial recommendations.



DAVIS
BORING TOOL DIVISION
of Giddings & Lewis Machine Tool Company
Fond du Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

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Taps Without a Name

These nameless taps have been closely controlled at every operation back to where they were cut off as blanks from a steel bar.

They should be, and probably are, perfect, *but* before they earn the right to bear the trade mark GTD they must pass this last test. The one on the lead tester already has passed within the plus or minus five ten-thousandths of an inch specified for one inch length of thread.

It'll do a good job for somebody! Maybe *you!*

GREENFIELD TAP and DIE CORPORATION

Greenfield, Massachusetts

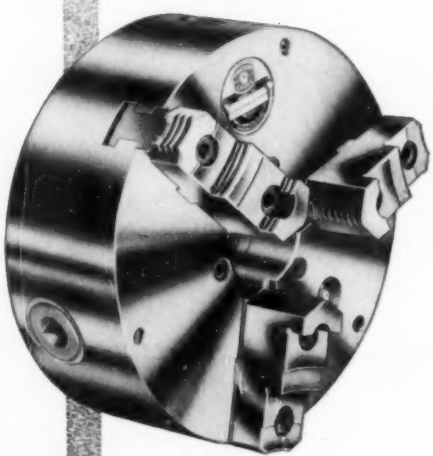
the finest precision lathes

Photo courtesy Hendey Div., Barber-Colman Co.

This is the NEW Hendey 32-Speed Geared Head Lathe which represents the finest in accuracy and production, in keeping with Hendey's long-standing reputation for the finest in lathes. Write the Hendey Div., Barber-Colman Co., Rockford, Ill., for complete information on this outstanding new lathe.

deserve the finest precision chucks

This is Horton's standard 3-Jaw Scroll Universal Chuck which has contributed to Horton's reputation for chuck leadership for over 100 years. Its precision and lasting accuracy make it a must in any production picture. For the complete story on the complete line of Horton Chucks, see the Horton people in your area now.



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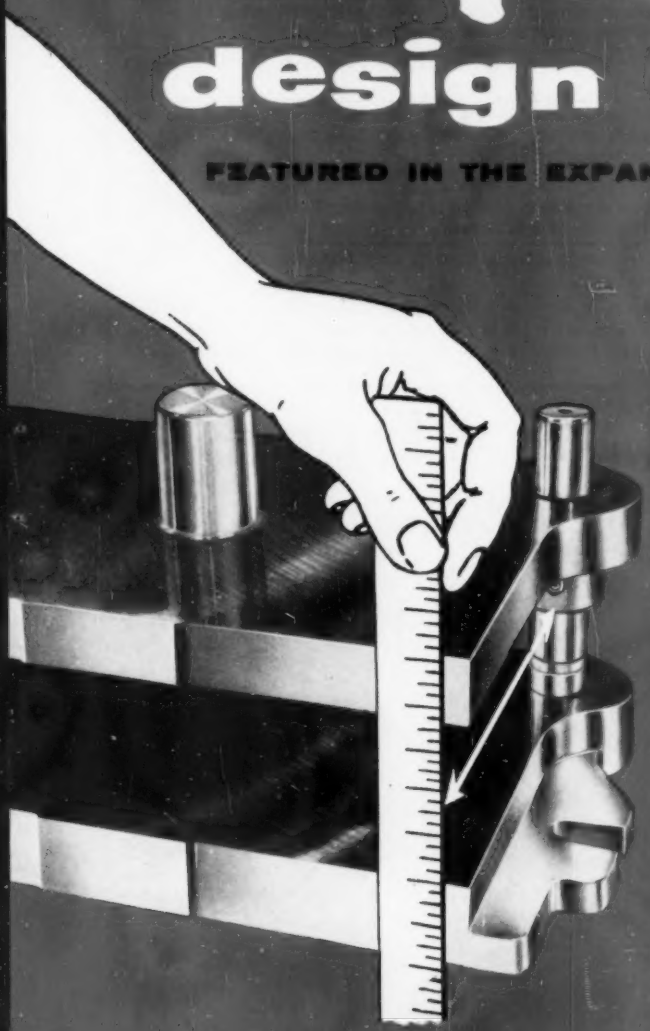
NEW design freedom

FEATURED IN THE EXPANDED DANLY DIE SET LINE

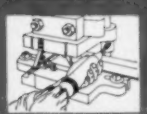


NOW Danly meets or beats all ASA standards . . .

with the world's broadest die set line. There's no need for compromise between the standard set you want and the set you can get, less need for costly specials. The new line of Danly Standard Die Sets has die space and guide post dimensions that equal, or exceed, ASA specifications. Under the new standards, front to back die space is measured *from edge of bushing to front of die set.*

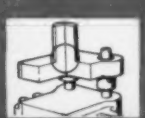
In addition to offering a complete selection of ASA standard die sets, Danly provides the Danly Standards proved popular over the years . . . all available from stock at your nearest Danly Branch. You can be sure of meeting all your die set needs at Danly . . . either ASA standard or Danly Standard.

NOW Danly offers you these additional features



Oil Lubrication System For Shoulder Bushing Sets. This new Danly die set feature assures longer life, easier maintenance, proper lubrication even during long runs.

All Horizontal Surfaces Ground On New Danly Die Sets. Horizontal surfaces, including top of punch holder and bottom of die holder, are ground to the same exacting precision as the inner die set surfaces.



Integral Welded Shanks. 100% weld on all steel sets regularly furnished with shanks gives greater strength and rigidity. Deep counterbores in punch holder have less tendency to weaken set.

DANLY®

DIE SETS AND DIEMAKERS' SUPPLIES

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois

PROPERTIES OF KENNAMETAL DIE GRADES

Grade	Hardness (Rockwell A)	Transverse Rupture psi	Young's Modulus of Elasticity psi	Compressive Strength psi	Suggested Applications
K82 K84 K86	90.0 91.0 91.5	275,000 300,000 250,000	65,500,000 74,000,000 72,000,000	663,000 600,000 590,000	Draw dies (all sizes) for drawing tubes, bars and wire; for cupping and deep drawing.
K90	85.0	360,000	61,600,000	518,000	Heavy blanking dies up to 3/16" steel. Dies for: cold-heading, nail gripping, nibbling, swaging steel rods, heavy curling, coining.
K91	86.5	380,000	64,400,000	540,000	Light-heavy blanking up to 1/16" steel; rivet sets, crushing hammers, washers, dies.
K92	87.5	385,000	71,900,000	572,000	Lamination dies on .004" to .035" silicon steel; medium blanking dies softer metals up to .040"; heavy forming dies; heavy heading machine hammers; hardware curling dies.
K94	90.0	325,000	77,900,000	600,000	Tube swaging dies; light blanking up to .020" silicon steel; medium blanking, softer metals up to .040"; heavy forging dies; heavy heading machine hammers; curling dies for hardware.
K95	90.5	300,000	82,000,000	644,000	Light blanking up to .015" silicon steel; light heading hammers; wear-resistant parts.
K96	92.0	250,000	94,300,000	800,000	Dies for asphalt floor tile; slate-covered asbestos shingles; abrasive-covered roofing papers; and in the paper industry for slitter knives and plates; blanking and pressing dies; compacting dies for powder metallurgy, wear-resistant parts.

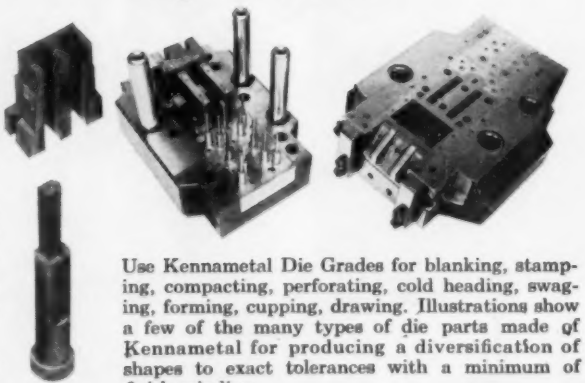
You can select the right grade of Kennametal* for each specific die requirement

With six grades in the "90 series" and three grades in the "80 series," Kennametal offers the right grade for any die application. The 90 series covers the full range of tungsten carbide grade requirements—from K90 with exceptional strength for heavy operations to K96 with maximum resistance to wear for such jobs as compacting and cutting highly abrasive materials.

In the 80 series, Kennametal offers three exclusive grades with unique properties not found in any other carbide. These three $WTiC_2$ grades, with a special slippery quality, have been created especially for drawing, forming and sizing operations where the slightest amount of galling or pickup cannot be tolerated.

From these two groups you can select the right grade for each specific job to assure highest production rates, to reduce die cost and maintenance, and provide products of uniformly accurate dimension and finish. Kennametal die engineers will gladly work with you in analyzing your die operations. They can show you performance reports on Kennametal over a wide range of applications—many of which may be similar to your operations. Call your nearest Kennametal office or write us direct. If you wish more information, send for Booklet B-100 and a copy of our new die grade selection chart. Kennametal Inc., Latrobe, Pa.

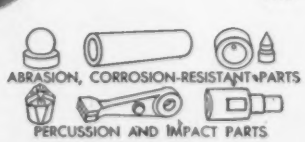
*Registered Trademark



Use Kennametal Die Grades for blanking, stamping, compacting, perforating, cold heading, swaging, forming, cupping, drawing. Illustrations show a few of the many types of die parts made of Kennametal for producing a diversification of shapes to exact tolerances with a minimum of finish grinding.

7209

INDUSTRY AND
KENNAMETAL
...Partners in Progress



Acme-Gridley

BAR and CHUCKING AUTOMATICS

...in the world's ONLY COMPLETE LINE of

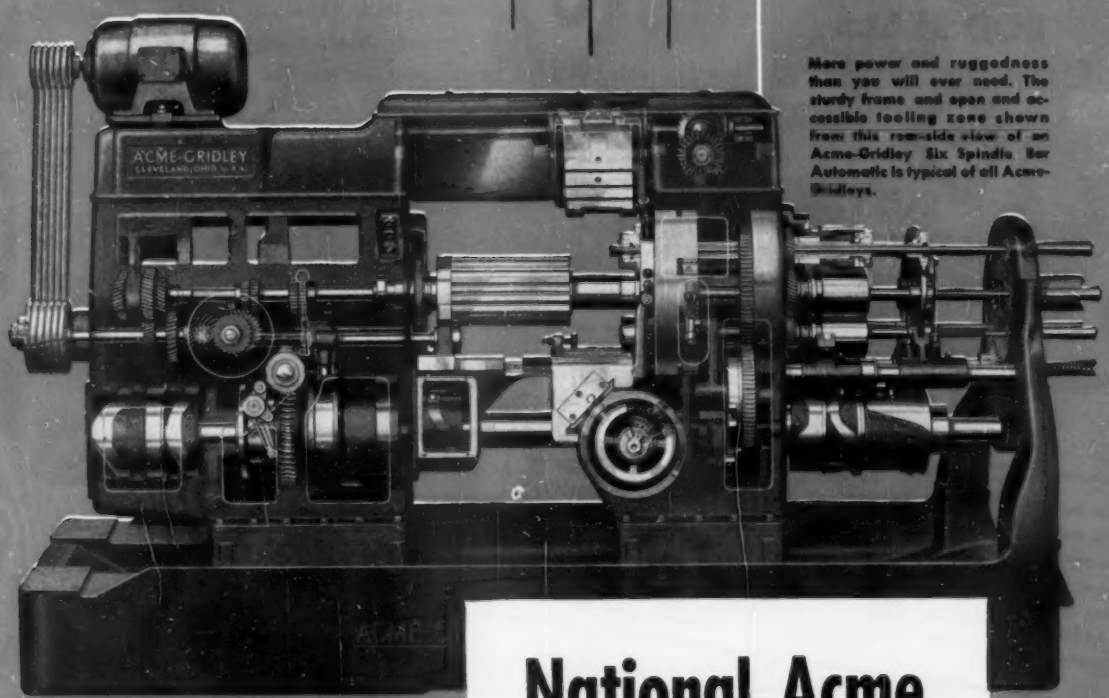
1-4-6 and 8-SPINDLE machine sizes

National Acme's experience in the design and manufacture of more than 50,000 *single and multiple spindle bar and chucking automatics* provides complete line experience and versatility no other manufacturer can duplicate. It assures the RIGHT machine for your job. Of equal importance, it gives you experienced and responsible sales, service and engineering help—*when you need it.*

Write for literature giving full machine details:

Multiple Spindle CHUCKING Automatics—Catalog CM-51
Multiple Spindle BAR Automatics—Catalog M-450-A
Single Spindle CHUCKING Automatics—Catalog MC-53
Single Spindle BAR Automatics—Catalog M-50-A

BAR MACHINES (9/16" to 7 3/4")				CHUCKERS (5 1/4" to 12")			
Number of Spindles				Number of Spindles			
1	4	6	8	1	4	6	8
3½"	1"	9/16"	5/8"	12"	10"	5¼"	6"
4¾"	1⅝"	1"	1¼"		12"	8"	8"
5½"	2"	1¼"	1⅝"			10"	
	2⅜"	1⅝"	2⅜"			12"	
	3½"	2"	4"				
	5⅜"	2⅜"					
	7¾"	3⅜"					
		4"					
		6"					



More power and ruggedness than you will ever need. The sturdy frame and open and accessible tooling zone shown from this rear-side view of an Acme-Gridley Six Spindle Bar Automatic is typical of all Acme-Gridleys.

National Acme

THE NATIONAL ACME COMPANY • 184 EAST 131ST STREET • CLEVELAND 8, OHIO

Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS

On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS

On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

Specify TEFLON HYDRAULIC ROD SEALS

On all Hydraulic Cylinders

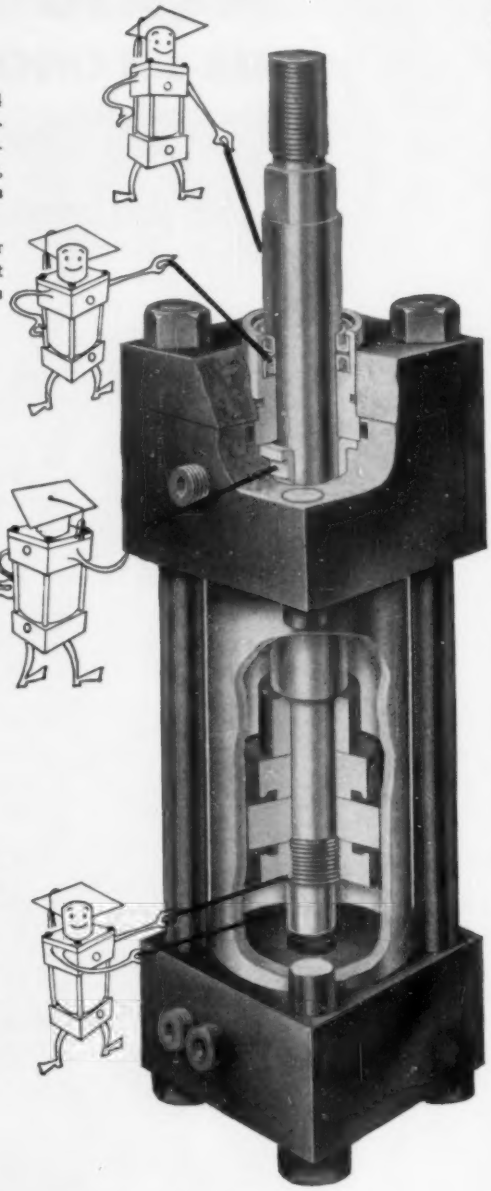
Specify RUST RESISTANT SURFACES

On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.) _____

"On all our future cylinder requirements, please specify the above quality features."

Signed _____

Title _____

EFFECTIVE DATES

These new Miller features will be provided at no extra cost after January 1, 1956—and at Miller's option prior to that date.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY
BUFFALO • ROCHESTER • MINNEAPOLIS • GRAND RAPIDS • DETROIT • FLINT
FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE
KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE
DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • ATLANTA
TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

In 1945-46 You Benefited . . .

From the following quality cylinder "Firsts" offered by Miller Fluid Power Company on its standard catalogued power cylinders:

1. Square bar steel heads, caps, and components
2. Welded fabricated steel mountings
3. Detachable, interchangeable steel mountings
4. High tensile steel tie rods (4 per cylinder)
5. High tensile steel piston rods
6. Chrome Plated Piston rods
7. Wrench flats on piston rods
8. Non-corrosive tubing on large bore air cylinders
9. Step-cut piston rings on hydraulic cylinders
10. Dirt wipers on air cylinders
11. Dirt wipers and oil wipers on hydraulic cylinders
12. Non-adjustable, bubble-tight, leakproof piston rod seals on air cylinders
13. Non-adjustable, bubble-tight, leakproof piston seals on air cylinders
14. Non-adjustable, leakproof, hydraulic piston rod seals guaranteed not to leak even one drop of oil
15. Non-adjustable, leakproof, hydraulic piston seals guaranteed not to leak even one drop of oil
16. 98% plus operating efficiency on air cylinders of 4" and larger bores at 80 psi
17. 98% plus operating efficiency on hydraulic cylinders of 4" and larger bores at 130 psi
18. 1 psi no-load break loose pressure on air cylinders of 3¼" bore and larger
19. 3 psi no-load break-loose pressure on hydraulic cylinders of 4" bore and larger
20. Seal life in excess of several hundred million feet of piston rod travel on all of the above-mentioned piston seals
21. Precision-seal cylinders
22. Seals that seal with pressure on all hydraulic static seals
23. Catalogued line of hydraulic cylinders of 2000 to 3000 psi operating pressure

In 1954 You Benefited again —from Miller's . . .

24. Sizable stock cylinder program
25. Model 77 heavy duty detachable foot mountings

In 1955 You Benefited again —from Miller's . . .

26. Greatly expanded stock cylinder program
27. Case-hardened, chrome plated piston rods
28. "Teflon" hydraulic piston rod seals
29. "Teflon" dirt wipers on air cylinders
30. "Teflon" dirt and oil wipers on hydraulic cylinders
31. High quality rust preventive finish on all parts not otherwise protected from rust on both air and hydraulic cylinders

Enter in boxes above the YEAR in which your supplier first (if at all) gave you these benefits.

In 1956, You Will Benefit Again . . .

Watch For MORE Miller Firsts!

TRIPLE ECONOMY *WITH* HELLER SAWING OPERATIONS

WHEN YOU HAVE ALL THREE UNITS FROM ONE SOURCE

1 THE COLD SAW

MODEL SSH-630-A
AUTOMATIC COLD METAL
SAWING MACHINE

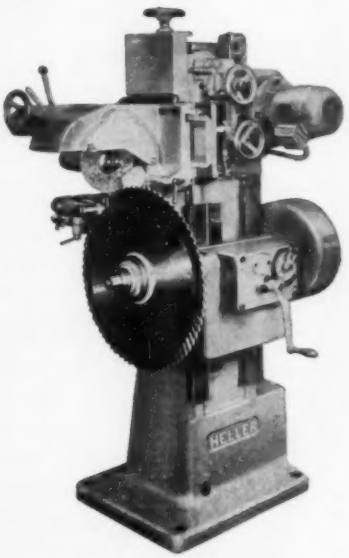
TRIPLE ECONOMY *with* HELLER

1. The Cold Sawing Machine
2. The Blade Sharpener
3. The Circular Sawblade

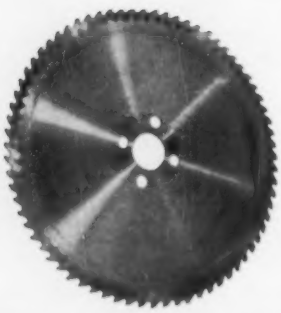
Economies are effected on every operation involved in cold metal sawing by taking advantage of the complete service available through Heller.

The specific savings offered by the use of the combination of Heller Cold Metal Saws, Heller Blade Sharpeners and recommended Sawblades becomes accumulative when used with each other.

2 THE SAW SHARPENER



MODEL B-650
AUTOMATIC SAW SHARPENING
MACHINE



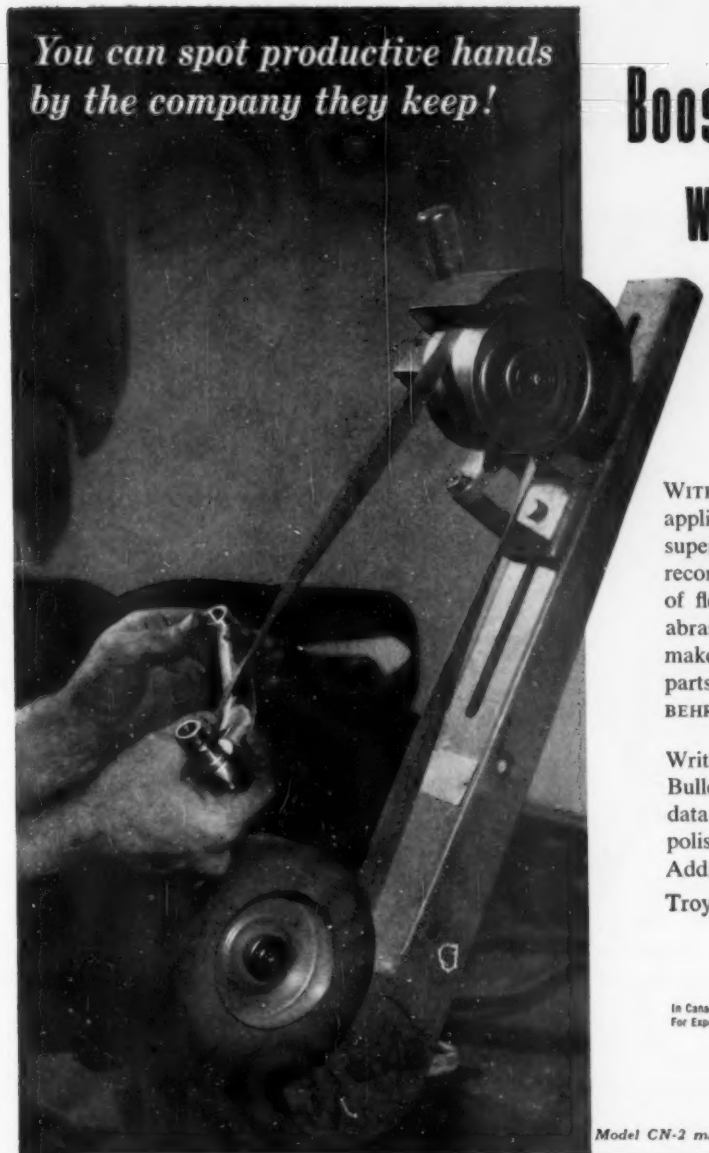
HELLER GIVES YOU COMPLETE SERVICE
WITH EXACTLY CORRECT BLADES.

3 THE SAW BLADE

HELLER MACHINE COMPANY, 114 Liberty St., New York 6, N. Y.

KNEE AND PLANER TYPE MILLING MACHINES • RADIAL AND COLUMN DRILLING MACHINES • TRANSFER MACHINES • SPECIAL MACHINES

You can spot productive hands by the company they keep!



Boost contour polishing with Behr-Manning abrasive belts!

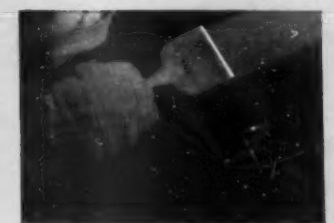
WITH THESE MODERN COATED ABRASIVE applications on hand, you can produce superior finishes on tricky contours at record breaking speeds. The combination of flexible, even-cutting BEHR-MANNING abrasive belts and up-to-date methods make this possible. Test them on your parts — in your plant or in a nearby BEHR-MANNING Demonstration Room.

Write for the Production Digest Bulletin. Contains 60 pages of detailed data on coated abrasive grinding and polishing techniques. Address Behr-Manning, Troy, N. Y., Dept. TE-1.

In Canada: Behr-Manning (Canada) Ltd., Brantford.
For Export: Norton Behr-Manning Overseas Inc., New Rochelle, N. Y., U. S. A.

Model CN-2 made by Engelberg-Huller Co., Syracuse, N. Y.

A favorite for dry fining and blending plumbing parts.



Smoothing the way to finer finishes on flat areas.

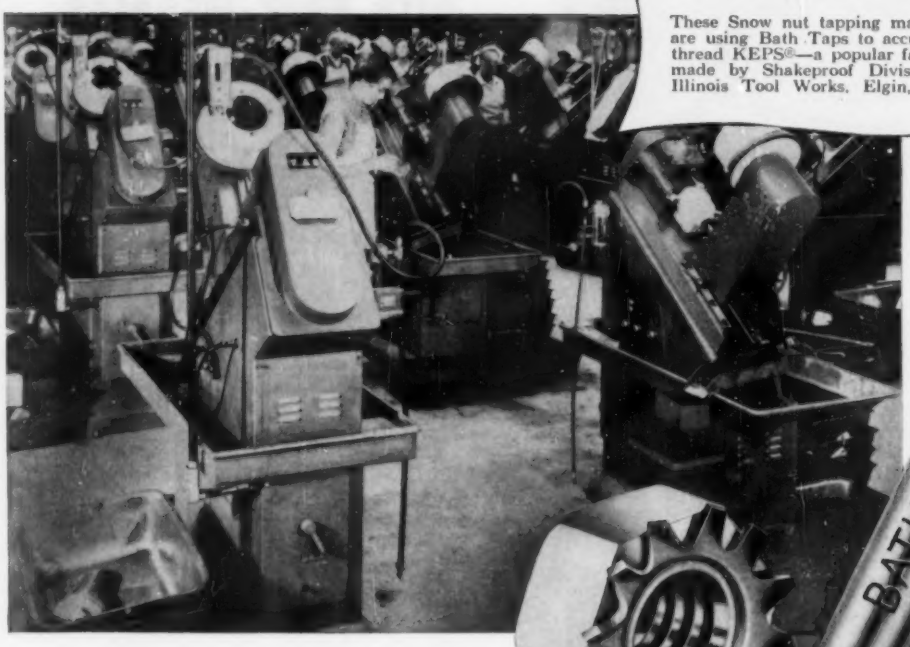
Tops for removing flash from difficult inside contours.

G-4

BEHR-MANNING division of NORTON Company

▲ COATED ABRASIVES ▲ SHARPENING STONES ▲ PRESSURE-SENSITIVE TAPES

another Bath Tap job well done.....
for SHAKEPROOF®



These Snow nut tapping machines are using Bath Taps to accurately thread KEPS®—a popular fastener made by Shakeproof Division of Illinois Tool Works, Elgin, Ill.

Tapping nuts is far from a "run-of-the-mill" job and the economy and precision of this operation is of prime importance in the manufacture of KEPS,® since these patented fasteners are used wherever accuracy and speed in assembly is vital.

Shakeproof finds Bath Taps have "a very satisfactory production life and stand up well under high speed . . . holding tolerances of the finished part that maintains a fine gaging record" . . . another example of a Bath Tap job well done!

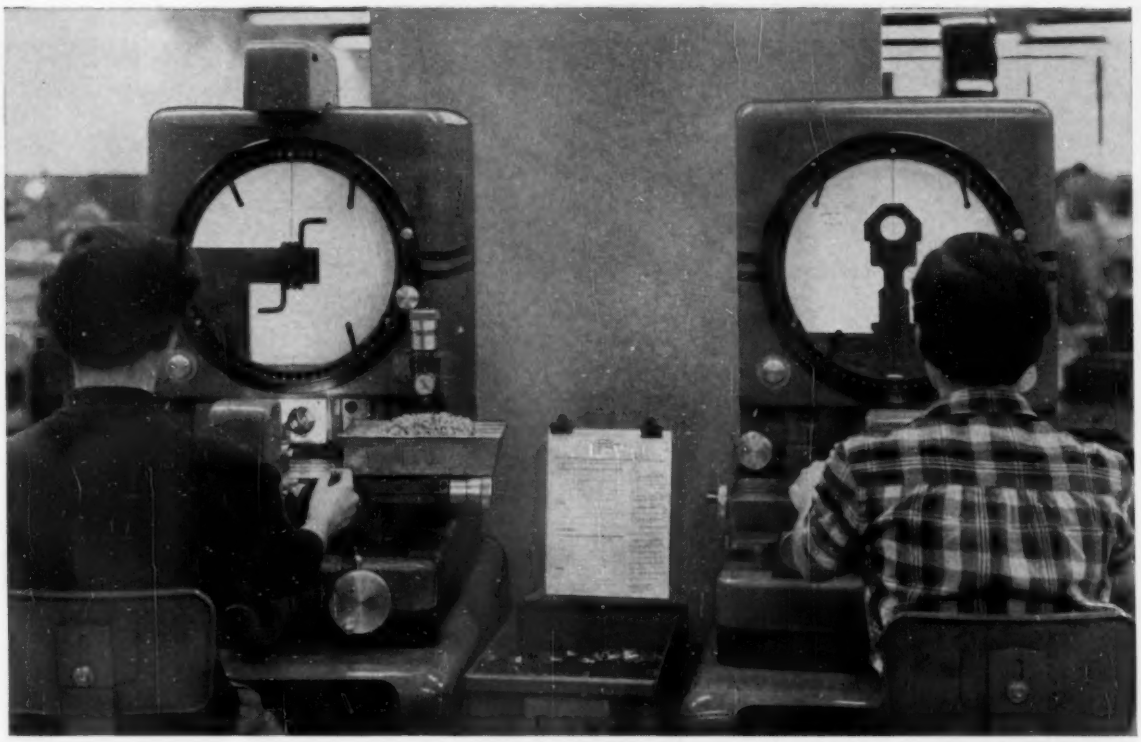
May we have our representative discuss with you, any threading problems that call for speed, accuracy and economy!

KEPS® — cold-formed nuts with free-spinning lock washers—are pre-assembled before being threaded by Bath Spiral Point Ground Thread Taps.

JOHN BATH & CO., Inc.

28 Grafton St., Worcester, Mass.

PLUG CYLINDRICAL AND THREAD GAGES • RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS



Girls at the Allen-Bradley Company, leading makers of electrical equipment, use Kodak Contour Projectors to inspect incoming precision parts quickly and accurately.

To speed parts from receiving dock to production . . . Allen-Bradley uses Kodak Contour Projectors

Receiving inspection can be a bottleneck, slowing the production operation when, on an average day, many separate shipments of component parts crowd the receiving room.

To avoid such a bottleneck and keep production lines moving, the Allen-Bradley Company combines statistical sampling methods with modern gaging equipment. Kodak Contour Projectors are used to check more than 400 different items, most having multiple dimensions and sample sizes of 35 or more pieces. Tolerances are held as close as .001".

Because optical gaging affords a check of several dimensions simultaneously, Allen-Bradley has cut inspection time dramatically: a typical part, requiring minutes to gage mechanically, now is checked in 12 seconds optically.

The result: No unnecessary delays—parts are quickly cleared for production. And quality control has improved.

You'll find that Kodak Contour Projectors are profitable wherever you need fast, accurate, complete inspection or measurement of almost any sort of part—simple or complex, large or small. And there are models to fit every need from the large Model 30 to the bench Model 8. To learn more about optical gaging and how it can help solve your problems, send for our illustrated booklet, "Kodak Contour Projectors." Use the coupon below.

the KODAK CONTOUR PROJECTOR

EASTMAN KODAK COMPANY 44

Special Products Sales Division, Rochester 4, N.Y.

☐ Please send me a copy of your booklet, "Kodak Contour Projectors."

☐ Put me in touch with your representative.

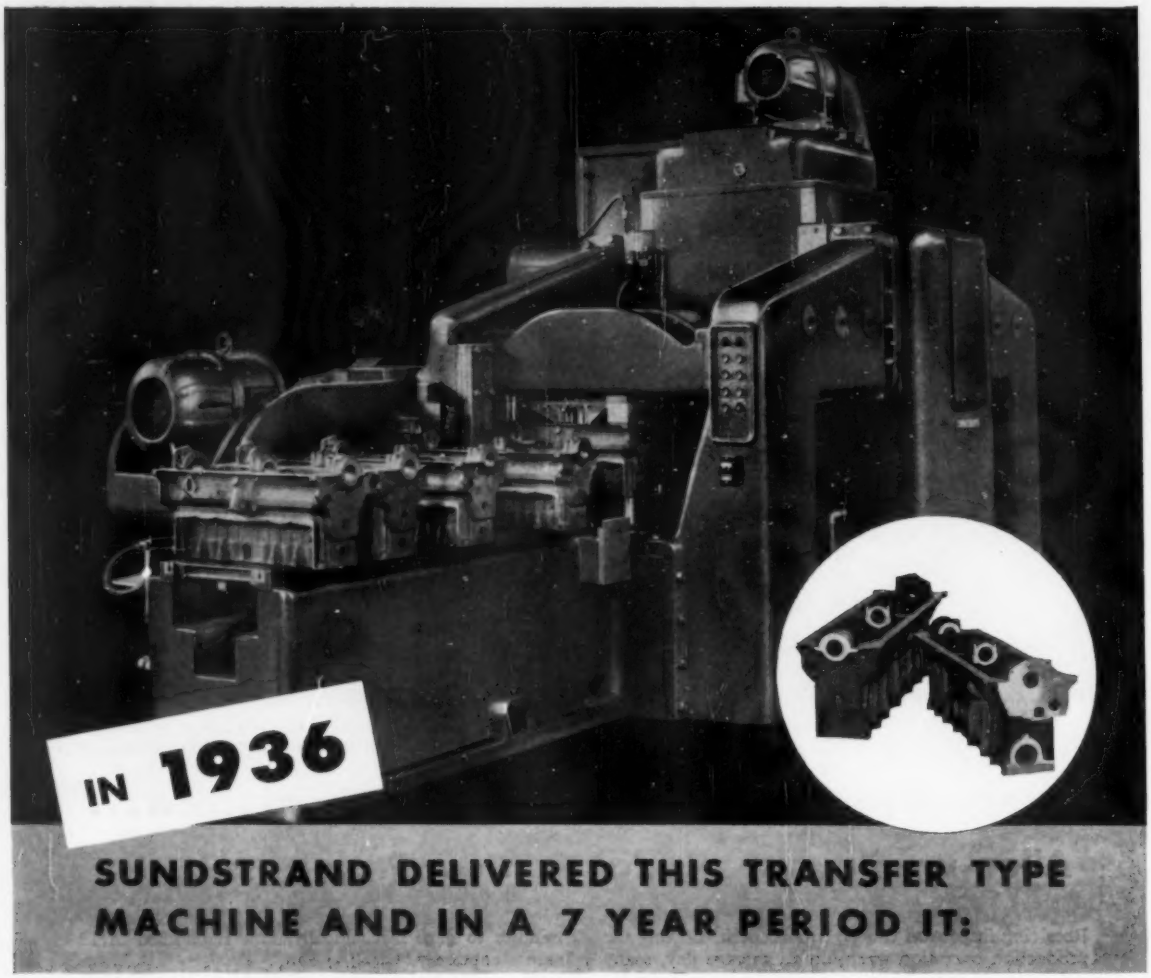
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____
(Zone)

Kodak



SUNDSTRAND DELIVERED THIS TRANSFER TYPE MACHINE AND IN A 7 YEAR PERIOD IT:

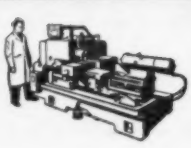
- **Automatically milled 16 surfaces each machine cycle**
- **Saved $249,984.00 per year in addition to increasing tool life**
- **Produced 8,750,000 cylinder blocks in 7 years**
- **Replaced 18 special milling machines**
- **Eliminated "Operator's fatigue"**

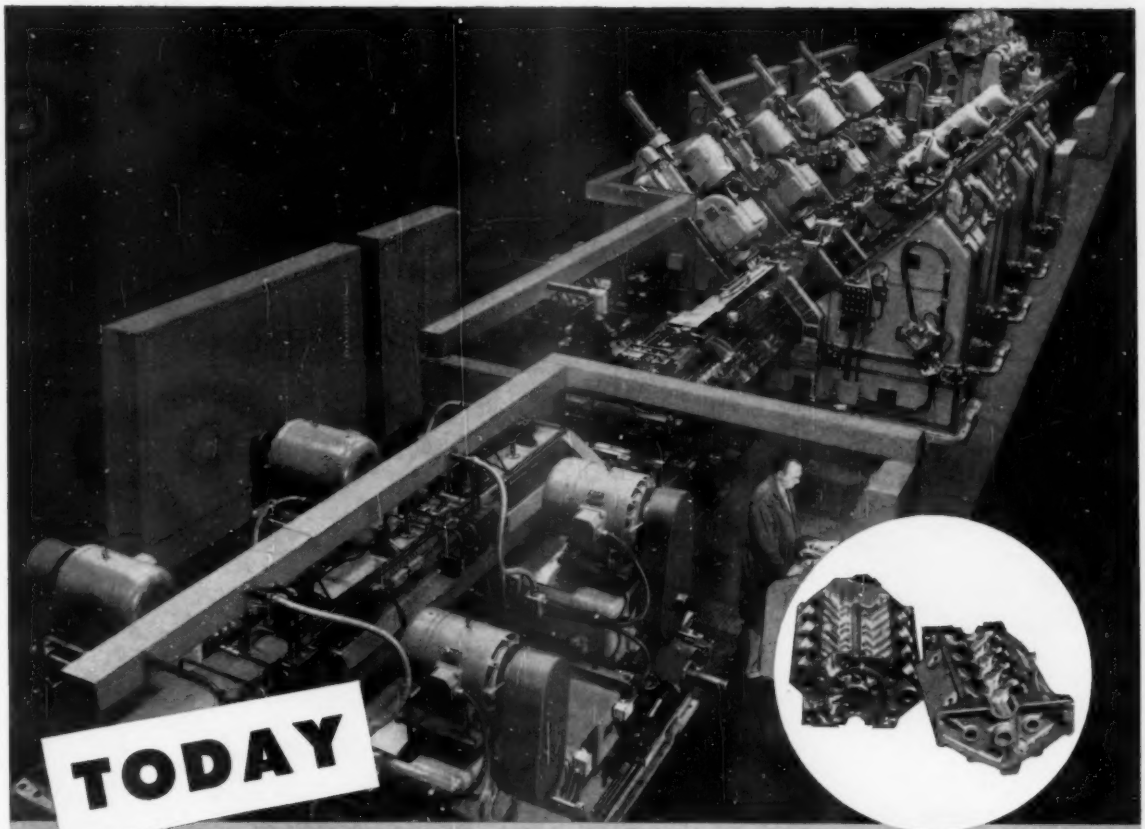
SUNDSTRAND

*"Engineered Production" Service**

*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





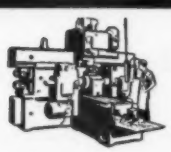
THIS SUNDSTRAND TRANSFER TYPE MACHINE:

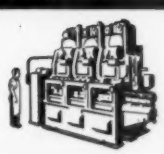
is performing similar operations automatically with comparable present-day savings.

SUNDSTRAND ***has pioneered in other progressive machine tool designs . . . .***

For Instance, most recent is the punch card controlled automatic lathe for turning shafts automatically. In the field of machine tools there are also progressive milling and turning machines and designs for accessory equipment. Get all of the facts. Write for a complete set of bulletins today. Ask for Set No. 763.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

ANNOUNCING

New Keller Portable Air Drills!

with 10 outstanding features that production men know will increase output . . . reduce costs.

- **MORE POWER**—Newly designed side air intake and exhaust porting provide for greatly increased power. Capacities up to ¼"—5/16".
- **LIGHTER WEIGHT**—Advanced engineering enables weight reduction along with greater power.
- **GREATER RANGE**—Provides speed-torque range from 600 to 17,000 rpm to meet practically all drilling requirements.
- **QUIET OPERATION**—Quietest drill with adjustable exhaust deflectors. Noise level is reduced by controlling the exhaust without sacrificing power. Operator fatigue caused by high noise level is minimized.
- **BALANCED DESIGN**—Shape provides utmost operator comfort and ease of handling.
- **SMALL SIZE**—Body diameter only 1½" with ¾" spindle offset.
- **SUSPENSION BAIL**—Standard equipment.
- **INTERCHANGEABLE PARTS**—Interchangeable gears, spindles, and chucks afford quick conversion to new jobs.
- **ONE-SHOT LUBRICATION**—With flush type fitting.
- **LOW AIR CONSUMPTION**—Side air intake and large exhaust parts provide low air consumption and more efficient operation.

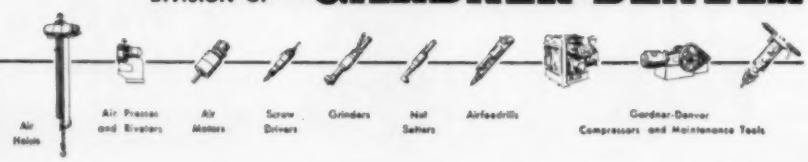
Write for Bulletin 11A giving complete information about these all-new KELLER Air Drills.

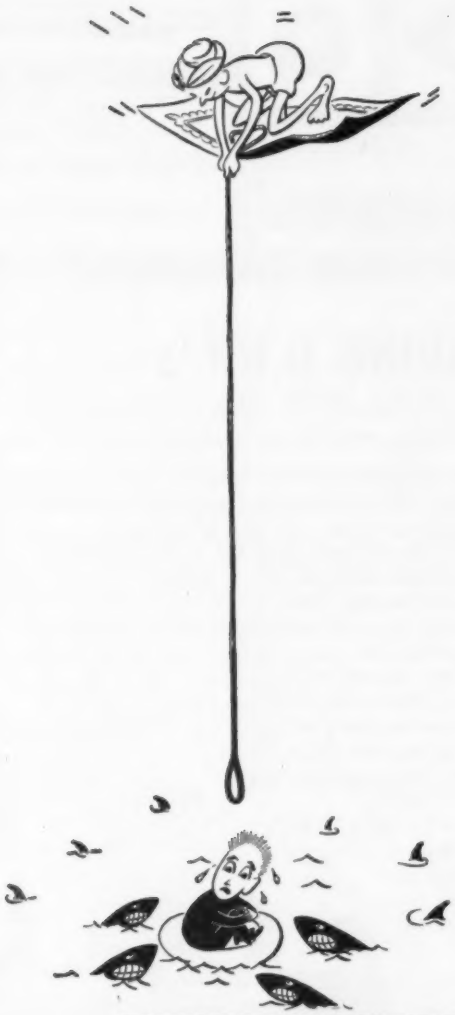
GARDNER-DENVER Since 1859 K KELLER TOOLS

KELLER TOOL

DIVISION OF **GARDNER-DENVER**

GRAND HAVEN, MICHIGAN





...for delivery when you need it

SEE YOUR

Threadwell

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FOR THE FINEST IN
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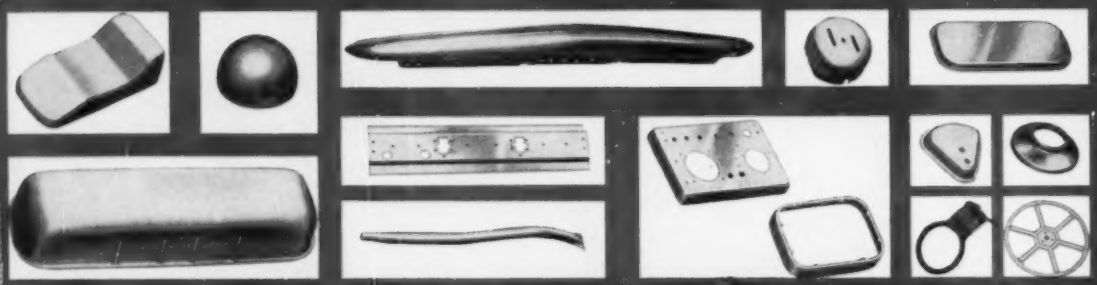

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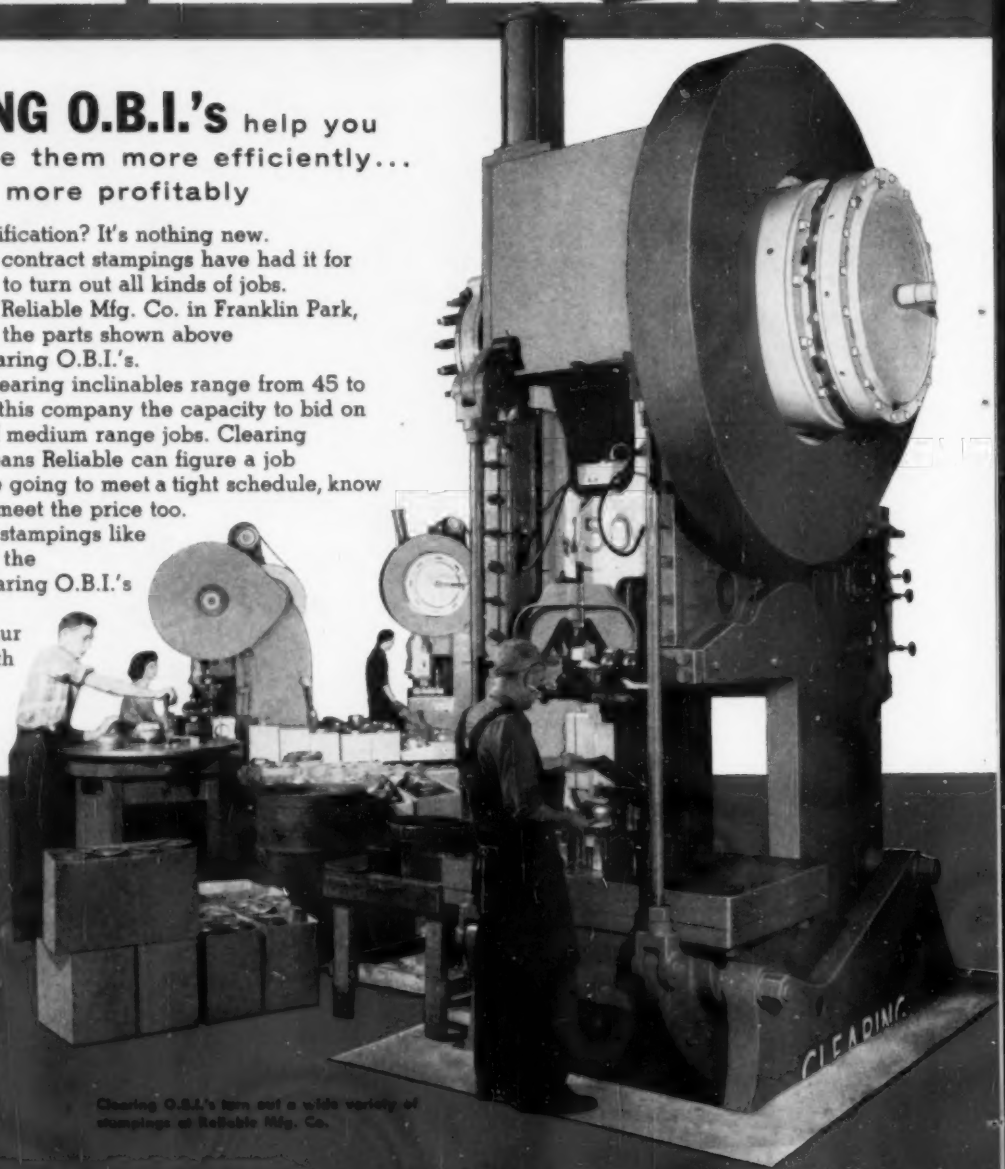

Clearing O.B.I.'s turn out a wide variety of stampings at Reliable Mfg. Co.

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CLEARING MACHINE CORPORATION *division of U. S. INDUSTRIES, INC.*

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The Tool Engineer

Let's Face It

The growth of our Society has been a gratifying development to all its members—perhaps more particularly to those who have taken an active part in chapter or national activities. Never before in our history have things run as smoothly nor have we been in as healthy a financial position. Now more than ever before sound policies which have been carefully evaluated by those men selected for that purpose—our Board of Directors—must be maintained or established.

It has been my observation that the selection of directors, and officers too, for that matter, has been generally a combination of reward for service, popularity contest and too often politics. Not enough consideration seems to be given to a man's real qualifications to fulfill the duties and obligations of the office to which he is elected.

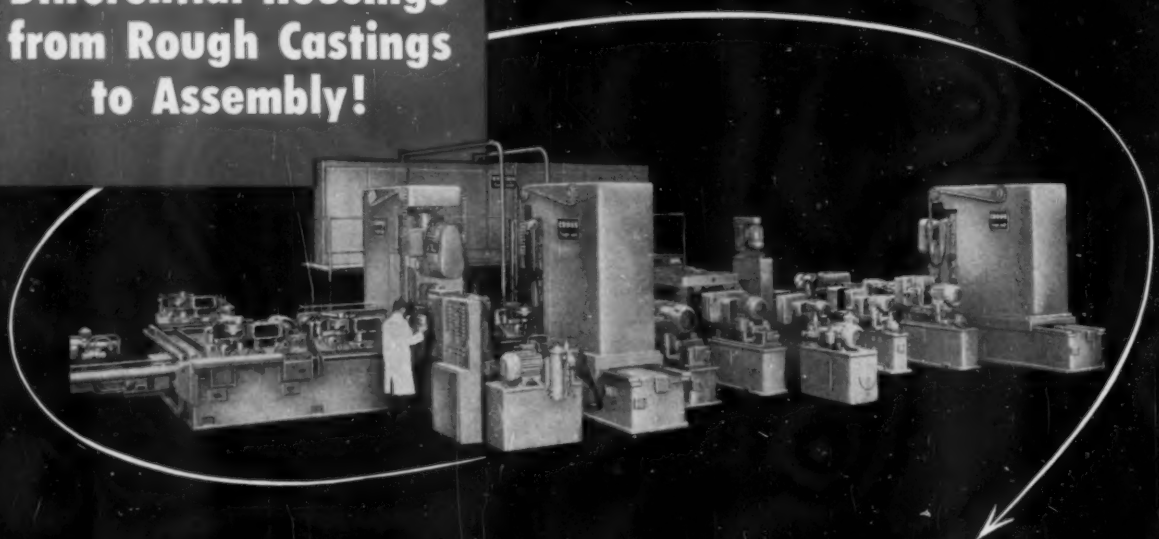
In my opinion we should change our past *modus operandi* of limiting our nominees to men who have been past "this" and past "that." We should seek those who have had the background and experience necessary to run a Society such as ours. Your Nominating Committee this year has taken this into consideration.

H. B. Osborn Jr.

PRESIDENT

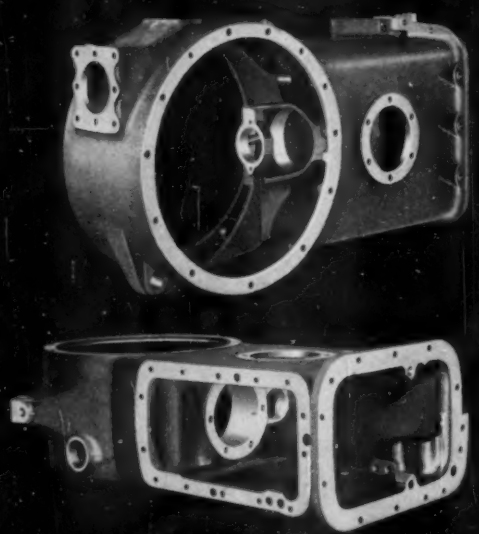
Tractor Differential Housings from Rough Castings to Assembly!

Another Transfer-matic by Cross



The new Cross Special Machine above is one of four sections which constitute a complete production line. Together, they process 46 tractor differential housings per hour from rough foundry castings to assembly. The line is 225 feet long with 31 stations. It performs 313 operations, including 19 milling, 7 cross-facing, 110 drilling, 17 boring, 72 chamfering, 4 spot-facing, 8 reaming and 76 tapping.

Like all Cross machines, the parts—even tooling details—are made to interchangeable tolerances for fast, easy maintenance and to provide flexibility for model changes—an important Cross advantage both from the standpoint of operating costs and investment. This production line is another example of Cross Sectionized (Segmented) Automation.



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Scholarships in tool engineering are awarded outstanding students at Utah State Agricultural College.

Growing Importance of Tool Engineering

By Frederick Preator

Head, Tool Engineering Dept.
Utah State Agricultural College
Logan, Utah

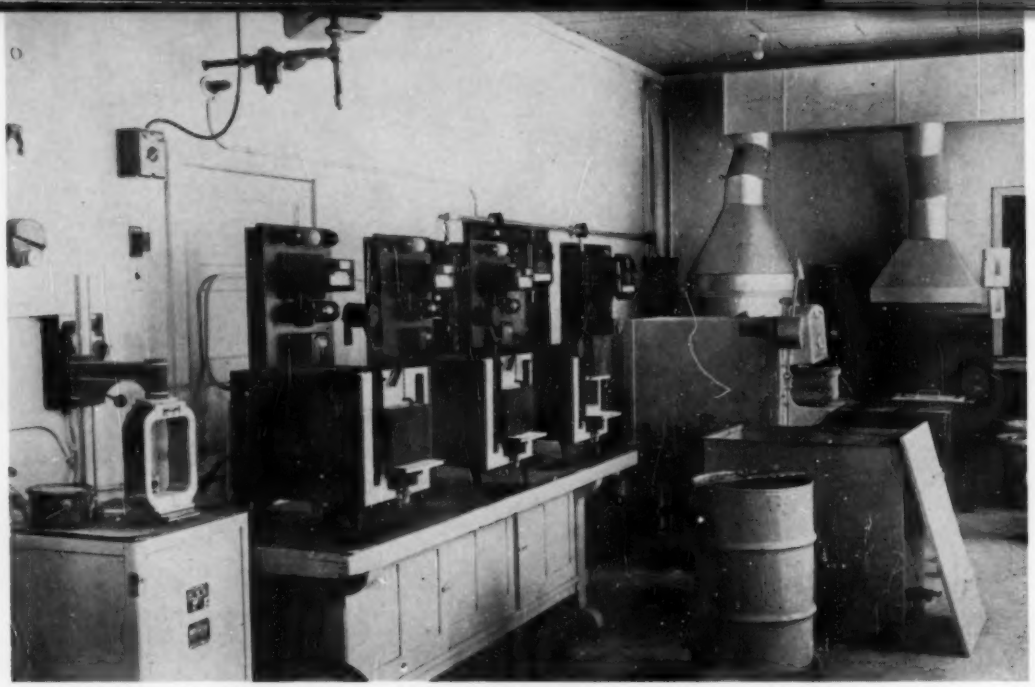
ONE OF THE OUTSTANDING characteristics of every civilization has been the birth and development of professions to meet its needs. This country is the home of engineered mass production. Wherever there is a product to be manufactured, there is engineering. There must be continued improvement. A product must meet competition. It must be engineered for a price. This is production tool engineering.

Professional recognition of the tool engineer has long been overdue. Perhaps there are several reasons for this delayed recognition of a branch of engineering which has contributed so much to improve social living standards, national defense and safety, and to peacetime economy. Industrial achievements and progress are scored with the names of inventors, industrial leaders and educators who have contributed much to industrial development and progress, frequently at great sacrifice. There has been a continuing and progressive development in industry which has kept new materials, machines, methods and engineering ideas in a fluid state.

In education, however, there has been an unwillingness to accept curricula in areas of learning other than the fields of the classics and the humanities. This reticence to broaden fields of study can still be felt among educators who rely solely on parent societies to pilot engineering education.

The position taken by educators on what is professional and what is vocational education has seldom helped to clarify the situation. Perhaps professional education is vocational education when its objective or that of the student is focused on a vocational end.

Entrance into industry has been and still is in many instances, made by way of the apprenticeship program. This kind of training program conducted in industry or a joint program with industry and the schools is not designed to furnish engineers. It has in many cases started young, aggressive men



Metals Processing is studied at Utah State by means of this heat laboratory.

on the engineering ladder to production engineering, even though this objective may not have been too sharply defined. This road is too long and costly to industry and student alike, as evidenced by the coming into being of such schools as General Motors Institute with its varied engineering curricula, and the desperate search being made by industries for production engineers.

Many engineering recruiters for industry are amazed to learn that there is a society interested in, and comprised of, engineers with production know-how. This field is not to be confused with industrial engineering, as occurred with one recruiter. He signed up eleven industrial engineering graduates of a midwestern university. Later, his firm learned they all were set for personnel administration and industrial management jobs. None were production-minded engineers.

Area of Knowledge

For clarity, the term "production tool engineer" will be used in this article. This term indicates the broad application of engineering principles to all phases of production from tooling. Thus, production from tooling is distinguished from production in the chemical industry, the electrical industry, agriculture, and other fields.

In the area of technical literature for the production tool engineer, there has been and continues to be, a shortage of fundamental texts on the college level. This is not because of a shortage of material, but because most of these writings find their place in current technical journals. There is a great need for this material to be organized and brought together as engineering fundamentals and put into standard texts for use in courses for the production tool engineer. This is particularly true in the fields of production materials, production methods, optical tooling, jig and fixture design, die design and production estimating.

The major areas of knowledge, interest and activity of the tool engineer, concern materials, machines and men. There is no production without grey iron, steel, steel castings, alloy steels, stainless steels, copper, bronze, aluminum, plastics, rubber, fibres and a host of new synthetic materials. Thus the latest carbides have increased production of one operation by 300 percent. The performance requirements expected of some newer products are demanding what seems like the impossible with present materials. Tomorrow they may be satisfied. Satisfying these material requirements is only one of the major factors. A material which defies processing by any of the known manufacturing methods offers little promise of usefulness, but perhaps the reward comes in the processing challenge it presents.

Cemented carbides are a good illustration of the challenge. In its primary condition, this material presented a problem which defied any of the known secondary processes of manufacturing, such as cutting, drilling, bending, forming or even grinding. With old-fashioned grinding techniques, the material wore away the wheel. Today, thanks to some engineering done by an obscure mechanic in a back garage in Pittsburgh, the previously impossible has been accomplished on this material, such as drilling polygon shaped holes with accuracies to the fourth

and fifth decimal and even drilling and reproducing an internal thread.

Indeed the production tool engineer must well know master materials, production materials and the new materials continually coming into manufacturing use. He must know machines, equipment and special tooling. Without such knowledge, it is impossible for the engineer to write out processing specifications for a product. Unless he is familiar with basic tooling operations, methods of handling, primary processing operations, design of special tooling, capacity of equipment, principles of economic planning, he cannot engineer a product for a price. Yet this is a fundamental concept in the American industrial economy.

As previously indicated, the production tool engineer works with men. Engineers usually work together in developing their plans. There must always exist a close cooperation between industrial design, materials processing, safety and production.

Management Responsibilities

Basically, the tool engineer is an organizer and planner. Continually, he is analyzing, organizing and planning the operations of the plant, tooling and people. Many professions lean on the tool engineer for their accomplishments. He is essentially an industrial executive and the greatest industrial expenditures are in manufacturing and processing industries. It is impossible for him to separate himself and his work from people and professional problems.

In a survey conducted in 1950, in an effort to measure executive responsibility of the production tool engineer, the following information was sought. Who was responsible for continued modernization of industrial plants? The proportionate size of the plants in numbers of employees? The relative influence of executives in the modernization of industry? Plants ranging in sizes up to 100 employees, to 1,000 employees, and over 1,000 employees were considered. Volume of business in these plants ranged from $50,000 a year to over $900,000,000 per year. The executive responsibility was divided into top management, operating management, plant management and tool engineering management.

Each of these four executive groups plays an important role in administration of the modernization plan, and has some responsibility for initiating, selecting and purchasing modern plant facilities and changes in processing methods. Individual industries were surveyed, such as automotive, appliances, agricultural equipment, electrical, munitions, machinery, power transmission, and several others.

The average for all industries, indicated that in the four management groups, 20 percent of the responsibility for modernization rests with the tool engineer. For the second responsibility of initiating, selecting and purchasing of modern plant facilities by the four managerial groups, it was indicated that 36 percent of the responsibilities are placed on the tool engineer.

In the breakdown by plant size, it is in the larger plants that the tool engineer carries the greater responsibility. In plants over 5000 employees, the production tool engineer carries 50 percent of the administrative responsibility for modernization, 75 percent of the administrative responsibility for selection of equipment, and 88 percent of responsibility for purchasing.

This look at the work areas and the responsibilities of the production tool engineer indicates that he is engrossed with problems which reach into all the fundamental fabricating processes. These in-

Production Tool Engineering Course

Freshman Year

Engineering Orientation
Basic Communications
General Inorganic Chemistry
College Algebra
Tool Engineering Orientation
Plane and Spherical Trigonometry
Descriptive Geometry
Engineering Problems
Machine Practice for Engineers
Military Science (required of all male students)

Sophomore Year

Plane and Solid Analytical Geometry
Mechanics and Molecular Physics
Electricity and Magnetism
Heat, Sound and Light
Machine Tool Operations
General Economics
Differential Calculus
Machining Processes
Inspection and Quality Control
Integral Calculus
Extemporaneous Speaking
Manufacturing Processes
Military Science (required of all male students)

Junior Year

Metal and Heat Treatment
Tooling Operations
Engineering Mechanics
Strength of Materials
Electrical Machinery
Tool Planning
Fluid Mechanics and Hydraulics
Welding for Engineers
Tool Processes
Applied Hydraulics and Pneumatics
Thermodynamics
Military Courses or electives

Senior Year

Production Tool Design
Plant Layout
Machine Design
Advanced Dynamics and Kinematics
Personnel Administration
Industrial Production Illustration
Stresses in Machine Elements
Technical Writing
Time and Motion Study
Aircraft Drawing
Engineering Economy
Manufacturing Analysis
Military Courses or electives

clude problems of materials, product design as it becomes a problem of design for production; cost estimating for production; design of production equipment; special tooling; purchasing equipment; production standards and precision control; production interchangeability not simply as it applies to dimensional accuracy but also to national and international standards; interchangeability as it is affected by new and varied materials as they come together in production; heat treatments designed to serve the wide range of usefulness of an increasing variety of new materials; machineability with all the attendant problems introduced with the new materials.

A piece of production equipment is no longer a simple spindle operating at a constant (slow) speed with movements actuated by lever arms and screws. A machine may have multiple spindles, operating over a wide range of controllable speeds. Its controls may be mechanical, electronic, pneumatic or hydraulic, singly or combined to control speed of operation, timing, precision, quality, output and cost of operation.

Each of the basic fabricating processes which bring materials into form and shape represents an area of activity with which the production tool engineer must be familiar and conversant. Some of these are the processes of rolling, casting, molding, forming, forging, welding and spinning. The materials list, their chemistry, their properties and their behavior in the production operations, and their susceptability to treatments represents a field of study for the production tool engineer which calls for the best from engineering students.

Basic machining processes must be well understood by the production tool engineer before he attempts any production tooling project. When he has analyzed his problem, made his comparisons by investigating all possibilities and drawn his conclusions as to materials, methods and design of equipment, he is brought face to face with the economics of the project. This requires that the engineer have some training in methods, cost estimating, purchasing and economics.

These demands exemplify the many others which call upon the education, training and the experience of the production tool engineer. Such demands are frequently made on the mechanical engineer, who unfortunately usually is lacking in this kind of education, training and experience development. He is generally unprepared for such an assignment calling for the exercise of these judgment factors. A retraining of the mechanical engineer is both time consuming and costly to industry and to the individual, frequently with no assurance that the engineer is happy in the assignment for which he is seldom well prepared.

Similarly, a careful study of many industrial

Inspection functions of manufacturing are part of the training of tool engineers at Utah State, as evidenced by this well-equipped laboratory.

engineering curricula reveals that unless there is a strong option in the production tool engineering field, these curricula generally lean more toward time study cases, plant operations, personnel administration and industrial management. This leaves the curriculum weak in production engineering and

Training Tool Engineers

Engineering fundamentals are essential to the production tool engineer's preparation and training, though not always applied as in traditional branches of engineering. What then is the type of engineer industry needs and is demanding? What is the professional area of training for this engineer?

At Utah State, a curriculum has been developed which is focused positively toward the tool engineer's objective. The following description of courses is taken from the general college catalog. They are presented in the order taken in four years, and total 205 college credit hours. In a land grant institution, military training for the first two years is required of all college male students. In the junior and senior years, a three-credit elective course is included in each quarter. This permits the student who passes these military requirements and the physical test, to satisfy the Reserve Officer Training Corps advanced courses and work toward his commission. For the student who does not qualify for military service, this permits a free elective course to strengthen his major objectives.

Perhaps this curriculum grew in its early stages a little like Topsy, as many curricula in other colleges and universities. But in one measure, it was continuously fortunate. It seems to have been directed by personnel who saw, consistently, the place of the engineer in manufacturing. It has progressed through the growing pains of peace and wartime experiences and expansion, the buffeting of curricula committees and professional recognition in the engineering school. It has been acknowledged by the state legislature through a change in the state law, which authorizes tool engineering to be taught on the college level in the School of Engineering in the state land grant college.

Emphasis in the first two years is on engineering fundamentals, as needed and required of all engineering students. A year of basic English, a year of engineering drawing and descriptive geometry, two quarters of chemistry, a year of physics, two years of mathematics with speech, economics, engineering problems and tool engineering orientation form the basis of the first two years of work. During the junior and senior years, basic engineering courses in mechanics, strength of materials, dynamics, kinematics, thermodynamics, fluids and electrical machinery are integrated with courses in tooling operations, tool design, manufacturing processes, manufacturing analysis, heat treatments, production design, plant layout, cost estimating, and in-plant training when cooperative summer employment is obtained.

Due to limitations of time, expense, facilities, personnel and other factors, any curriculum may leave much to be desired. The progress that this curriculum has made, as evidenced by the placement of students in the manufacturing industries, the success of the students, and the inquiries and commendations which come from students and industry alike, is both satisfying and encouraging.

In the last Engineering Council for Professional Development committee report, the following curricula were approved: agricultural engineering, aeronautical engineering, architectural engineering, ceramic engineering, geological engineering, geophysical engineering, industrial engineering, engineering math, engineering mechanics, naval architecture and marine engineering, petroleum engineering, engineering physics, sanitary engineering and textile engineering.

More Engineers in Manufacturing

Additional curricula may be approved by the education committee. Why not production tool engineering? The diversion of more and more engineers into the manufacturing industries and in manufacturing processes is evidence that industry must have men with know-how, resourcefulness, ingenuity and creative ability to translate the work of science and research into the manufactured product.

The interests, activities and fundamental areas of knowledge so necessary for the production tool engineer are not traditional areas of study of the mechanical engineer. Neither are they satisfied by the industrial engineer when the major emphasis is on case studies of management and labor relations. Yet, a survey by the Engineers' Joint Council appointed in 1946, pointed out that over 40 percent of the engineers in this country are in a manufacturing industry with but little, if any, training directed towards this objective. The same report indicated that where as the majority of engineering curricula is pointed toward design, only 15 percent of engineers are engaged in this function. Actually, 40 percent figure is conservative even in 1946. According to reports from some parts of the country, as high as 78 percent of the engineers are in manufacturing industries in some capacity. These facts serve to indicate further the importance of manufacturing engineering in the economy. American inventions and achievements have been the result of dreams, ambitions and developments of research engineers, but it is in the realization and utilization of visions by the production tool engineer that has made possible the highest standard of living enjoyed by any people in the world.

Gadgets

Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work

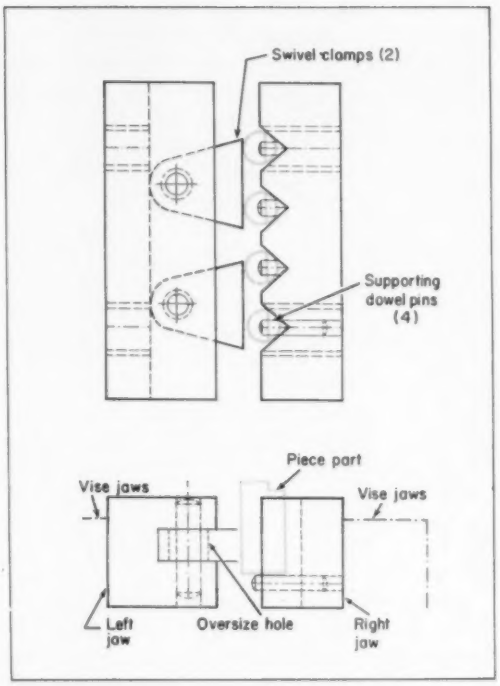
Equalizing Jaws for Milling

Frequently it is necessary to perform a milling operation on small diameter parts, which presents a difficult clamping problem. The equalizing vise illustrated was designed to solve such a situation and the principle can readily be applied to a variety of similar conditions.

A rectangular slot in the left jaw holds two swivel clamps, which have oversize holes and are retained in position with two dowel pins. To position the piece-parts V's are provided in the right jaw. Dowel pins are used to support the parts at the proper height.

When the jaws are closed the swivel clamps compensate for any small differences in diameter which might occur in the piece-parts. The oversize holes are used in retaining the swivel clamps so they will contact the surface at the back of the slot for support, rather than put strain on the retaining dowels.

F. C. Elmo
Dayton, Ohio

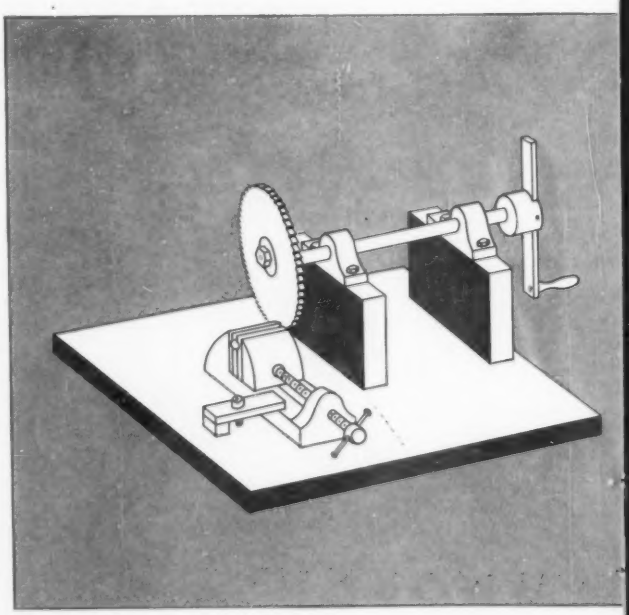


Hand Milling Machine

In running production jobs on a number of small parts the shop found that many milling operations were required. Mostly these are screw machine parts and only a small amount of stock need be removed by milling.

On this type of operation it was found that higher production can be secured by special hand-powered millers than with standard milling machines. The shop-built machine shown in the accompanying sketch utilizes pillow blocks mounted on raising blocks. These pillow blocks support a shaft, one end of which is fitted with an adjustable length crank. The other end is turned so as to be eccentric. On this end is installed a large diameter fine-tooth milling cutter.

The work can be held in a vise, collet or holding fixture. The sketch shows a drill vise but frequently a fixture with a miniature air clamp is used. The amount of eccentricity of the shaft depends upon the work. An eccentricity of ⅛ inch permits a depth of cut of about ¼ inch. The handle is mounted so



it is the lowest position when the cutter is at its highest position. This arrangement provides clearance for loading the fixture.

As the cutter is rotated it gradually feeds into the work and out again. The cut is completed in one revolution. The depth of cut is controlled by the location of the fixture. When using a vise with special jaws, as illustrated, the depth is controlled by moving the vise forward or back from the cutter. Cutters are available in various thicknesses and in diameters up to 6 inches. The 6-inch cutters have as many as 460 teeth, so cut per tooth is small.

Some of these units have been built with an eccentric collar surrounding the eccentric on the shaft. Rotating the collar adjusts the eccentricity of the cutter. Generally these machines are mounted on the end of the bench so the handle will swing below the base when extended full length. If desired a guard can be placed over the cutter.

These machines produce a cut surface which is slightly concave, but the concavity is hardly noticeable. For example, on a $\frac{3}{16}$-inch cut surface made with a 6-inch cutter the hollow in the center of the cut will be less than 0.0015 inch. These machines are easy to build and provide versatility for job lots with a small investment.

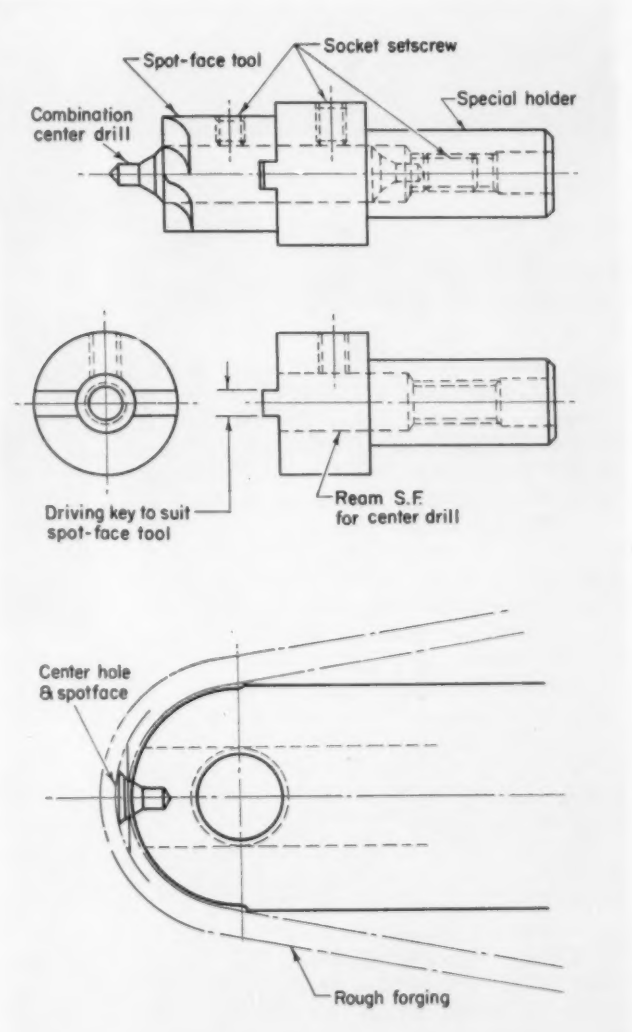
H. Koslow
Bronx, N. Y.

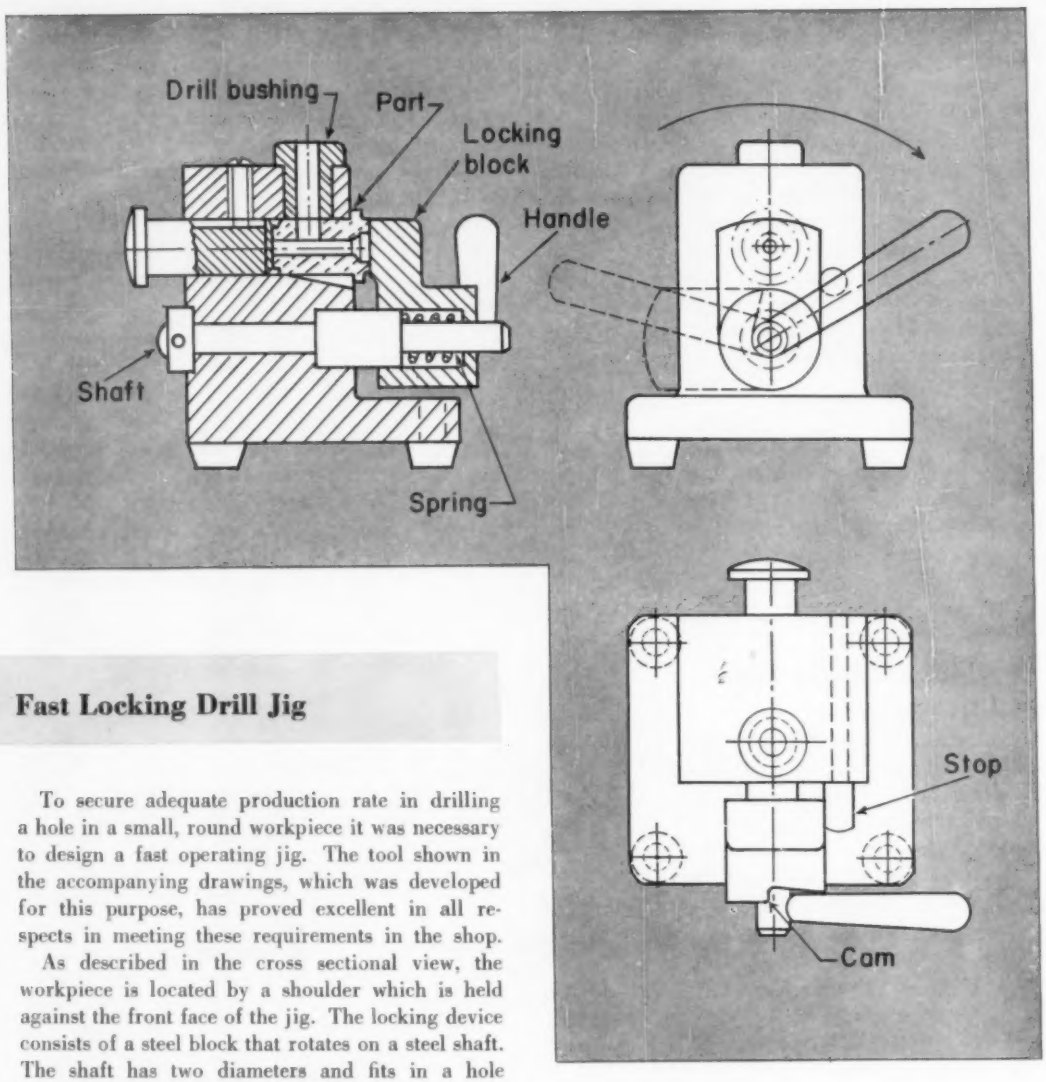
Combining Spotfacing and Centering

Sometimes a face must be machined on the end of a part, adjacent to center holes. One such case involved a production lot of large stainless steel forgings. The workpiece was over 2 feet long and approximately 40 lb in weight. The centers were to be used for tool location purposes in turning an outside diameter. After this operation a hole was to be gun-drilled through the length. The flat end-face was equipped to seat the gun-drill bushing. The workpiece is shown in the accompanying sketch.

To center and face the ends separately would require two operations with costly duplicate setup and handling. A special low-cost holder was made to hold a standard combination center drill and a spotfacing tool, as illustrated. With this tool, both cuts were combined into one operation, eliminating the cost and delay of a second operation. The special holder is adaptable to many similar parts.

W. R. Eldridge
Little Rhody Chapter





Fast Locking Drill Jig

To secure adequate production rate in drilling a hole in a small, round workpiece it was necessary to design a fast operating jig. The tool shown in the accompanying drawings, which was developed for this purpose, has proved excellent in all respects in meeting these requirements in the shop.

As described in the cross sectional view, the workpiece is located by a shoulder which is held against the front face of the jig. The locking device consists of a steel block that rotates on a steel shaft. The shaft has two diameters and fits in a hole drilled in the locking block. The shaft is free to rotate in the counterbored hole in the jig body. A coilspring is somewhat compressed and installed on the smaller diameter of the shaft, resting against the shoulder of the shaft and the bottom of the locking block. A handle driven on the shaft completes the moving parts.

When the jig is in the open position, the handle and locking block have the position shown by the dashed lines in the end elevation. When the jig is loaded with a workpiece, the handle is turned in the direction shown by the arrow. The locking block follows the shaft when the handle is turned, because of friction between the shoulder of the shaft and the bottom of the block due to action of the coilspring. As the handle is turned in the direction of the arrow, the locking block is stopped by a steel pin. When the operator rotates the handle further, the locking block is forced in against the workpiece because the handle is working against a cam or curve milled on the block. This causes the block to lock the piece firmly in the jig. The loading operation is performed in a moment.

Hjalmar Dahl
Upplands Vasby, Sweden

ultrasonic testing

prevents press crankshaft failures

By Leon Boyko
Sperry Products, Inc.
Detroit, Mich.

SMASHUP CAUSED BY a 2000-pound flywheel tearing from its press crankshaft halted operations of the day shift in the pressroom of a Detroit area firm. Investigation revealed that the crankshaft had been cracked, causing the failure. No one was hurt by this accident, but division management, whose established policy was to keep all presses working at maximum efficiency with full safety for employees, realized their policy was inadequate. Someone could have been hurt.

As presses age, their crankshafts tend to develop fatigue cracks because of overwork and overloads. Eventually, these cracks lead to breakdowns. Since one crankshaft had already failed, management had to know the condition of the remaining presses. Broken presses ruin operational efficiency and might hurt employees during smashup. Each press would have to be examined for evidence of fatiguing.

Management was faced with a dilemma. To inspect the presses by conventional disassembly and visual examination would take presses out of operation, a violation of established policy. By not inspecting the presses, future operations might be dramatically halted by another press failure with possible injury to personnel, also a violation of policy. The dilemma was presented to a central laboratory in the corporation.

After studying the problem, laboratory personnel decided that the only way around the dilemma was to inspect the large number of crankshafts without disassembling the presses. Engineers decided to try a Sperry Ultrasonic Reflectoscope for the purpose. It was believed this instrument could be used in nondestructive tests to quickly determine points of potential danger in the remaining crankshafts.

An ultrasonic instrument was selected because it can indicate the internal condition of materials such as steel when only one side of the test piece is accessible. Such instruments can be used to discover either surface or internal defects. It is only necessary that the test piece side exposed for search be smooth and clean to insure intimate contact with the search unit. Defects are located and identified when ultrasonic sound beams are introduced into the test piece, reflect from it and are indicated on a cathode ray tube, *Fig.* 1.

The Reflectoscope produces pulses of ultrasonic sound waves that are beamed into material normal to the test surface, or at a convenient angle, by the application of a piezo-electric search unit. Such

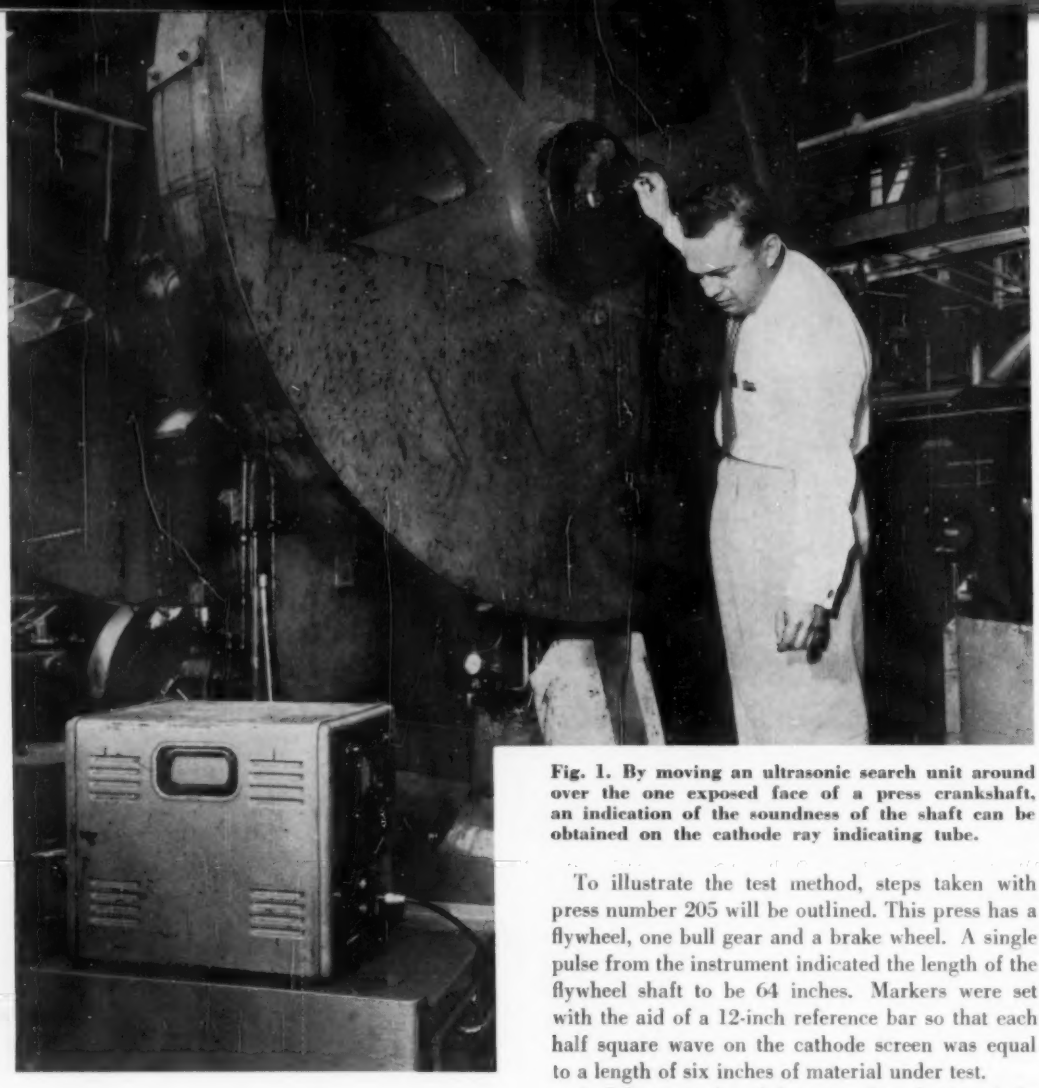


Fig. 1. By moving an ultrasonic search unit around over the one exposed face of a press crankshaft, an indication of the soundness of the shaft can be obtained on the cathode ray indicating tube.

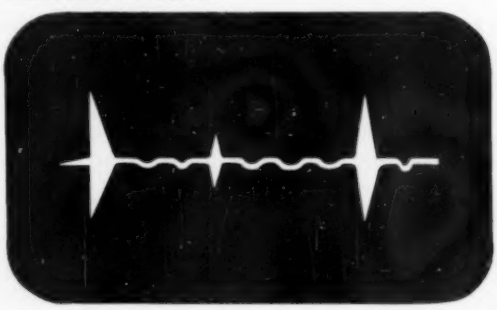
search units convert electrical oscillations into mechanical vibrations and vice versa. Sound waves introduced into the test piece travel through it until they are reflected back by the opposite side or by a discontinuity. The returning sound waves are converted into electrical impulses by the piezoelectric search unit and show as a definite pattern on a cathode ray tube, *Fig.* 2. A system of distance markers is used to accurately locate any discontinuities.

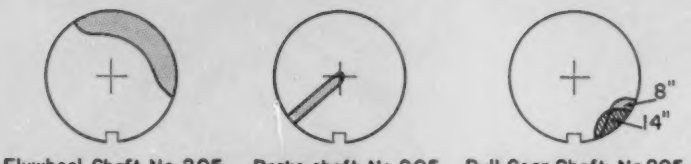
Ultrasonic tests on the presses were concentrated on those areas offering the greatest potential danger, such as an overhanging wheel supported by a bearing at only one side. The most critical area was considered to be the fillet between the wheel and the bearing. Preparations for the test included smoothing and cleaning one end of the shaft to provide suitable contact for the search unit. A disk sander was used to remove all paint, grease, oil and rust. Shafts of some of the presses had small timing gears or other caps covering their ends, which had to be removed before the test could be run.

To illustrate the test method, steps taken with press number 205 will be outlined. This press has a flywheel, one bull gear and a brake wheel. A single pulse from the instrument indicated the length of the flywheel shaft to be 64 inches. Markers were set with the aid of a 12-inch reference bar so that each half square wave on the cathode screen was equal to a length of six inches of material under test.

A defect was found between the wheel and the bearing, in the critical area. The defect was located 10.25 inches from the test end, near the periphery, and extended about one-quarter of the way around the shaft, *Fig.* 3. The original back reflection had been set to maintain an amplitude of two inches on the screen. The defect amplitude was about one-

Fig. 2. Typical pattern found during a reflecting ultrasonic test. The left-hand indication is of the initial pulse, the right-hand indication is a reflection of the far end of the test piece and the middle indication shows a defect.



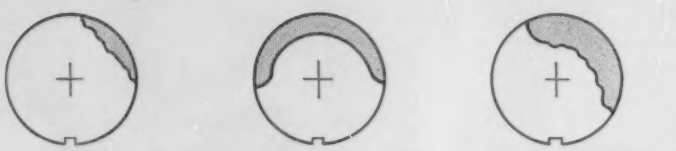


Flywheel Shaft No.205
Back reflection No.64"
Defect indication:10.25"

Brake shaft No.205
Grease hole 19"

Bull Gear Shaft No.205
Back reflection:20"
Defects: 8" and 14"

Fig. 3. Magnitudes and locations of defects can be determined throughout the lengths of shafts. The middle indication was regular and, after consulting a blueprint, was identified as a grease hole.



Flywheel Shaft No.209
Back reflection: 24"
Defect indication:19"

Flywheel shaft No.212
Back reflection: 24"
Defect indication:11"

Bull Gear Shaft No.169
Back reflection:24"
Defect indication:11"

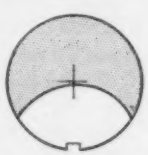
Fig. 4. Typical indications of defects found by ultrasonic tests with a minimum of lost production time. Test time per shaft was about 20 minutes after cleaning.

quarter inch and caused the back reflection amplitude to be slightly less than two inches. This defect was not serious enough to require removal of the press from operation but data was recorded so that periodic checks would show the rate of crack growth.

The end of the shaft supporting the brake showed a discontinuity 19 inches from the test end. This was the only defect indicated and consulting a blueprint proved that this was the location of a grease hole, *Fig.* 3.

Back reflection of the bull gear shaft indicated a length of 20 inches. Two defect indications showed up in a small area, one 8 inches and the other 14

Fig. 5. Most seriously damaged of the unbroken crankshafts was selected by ultrasonic testing.



Flywheel shaft No.202
Back reflection:65"
Defect indication:10.25

Table 1—Result of Ultrasonic Inspection of Press Crankshafts.

Press No.	Defect Indications S	M	L	Remarks
139				OK
140				Crack 7" from test end.
149				OK
150				OK
151				OK
153				OK
155				OK
156				Cap welded on. No test.
159				No penetration. No test.
160				OK
161				OK
169				Crack between wheel and bearing ¼ way around two inches deep.
200				OK
201				OK
202				Large crack.
203				Crack 18" from test end.
204				OK
205				Crack between wheel and bearing.
206				OK
207				Small crack.
208				OK
209				Crack between wheel and bearing.
210				OK
211				OK
212				Crack between wheel and bearing ½ way around, not deep.
213				OK
214				Crack between wheel and bearing.

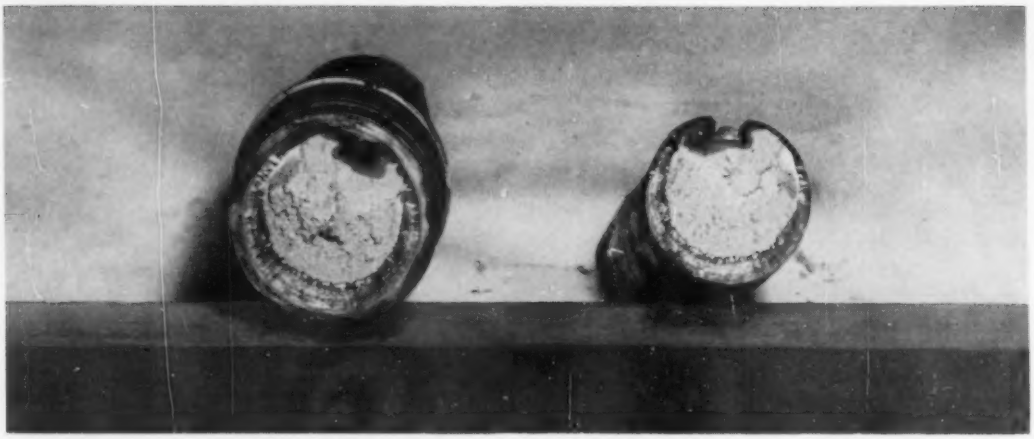


Fig. 6. The defect indicated in *Fig. 5* was proved by removing the shaft and purposely breaking it. It broke right at the indicated fatigue crack and the condition of the fracture was proof of the failure that could have occurred during production.

inches from the test end, *Fig.* 3.

All remaining presses were checked using the same procedure. Test results are shown in TABLE 1 and typical indications of defects are shown in *Fig.* 4. Nine shafts showed indications of some defects. Five of these indicated serious defects in the area between the wheel and the bearing.

To verify the results of the ultrasonic tests, press number 202 was disassembled. This press was chosen because it showed the largest defect, *Fig.* 5. The flywheel shaft was broken in a hydraulic press with failure occurring at the location of the large fatigue crack indicated in the ultrasonic tests, *Fig.* 6.

Based on this corroboration of the ultrasonic tests, management decided to replace with new shafts the four others that had shown signs of large cracks in the critical area between the wheel and the bearing. It was decided not to replace the shafts with lesser defects but to institute periodic ultrasonic tests. Such tests would check the growth of known defects and would point up new defects as they started. By periodically checking shafters, management could order replacement parts in ample time to prevent long production delays while maintaining a policy of working presses at maximum efficiency without danger to employees.

Ultrasonic tests provide accurate results with a complete picture of potential troubles. After cleaning, it required only about 20 minutes to check each crankshaft. Savings introduced by this inspection method are doubly important because presses can be shut down for short periods at the convenience of the maintenance crew rather than completely because of mechanical failure.

Management Benefits from Electronic Tool

An electronic data processing system, including a Univac, is going to speed reporting as well as keep paper work under control at The Carborundum Co.'s plants and sales offices around the country.

Univac is a giant electronic brain that calculates with the speed of electrons; a magnetic retentive faculty provides the operator with specific information gained from the calculations. In use at Carborundum, this magnetic "memory" will tell the operator the quantity and inventory location of any abrasive product made by the company. In other calculations, it will figure payroll, compute costs, put a customer's order in the plant, or figure out a mathematical problem for research in shorter time than it normally would take simply to explain it.

For Carborundum's use, a plan has been engineered for the practical operation of electronic equipment as a unified compatible system to service practically every important phase of the company's paper work. By making important facts available quickly, it will give management an opportunity for better planning and sharper control of the business. It also will expedite customer service and provide a tool for increased sales.

Installation is scheduled to begin the latter part of 1956 or early 1957. After testing, data processing operations will be converted to the new system. To complete the conversion, according to an orderly progressive schedule, is expected to take from 3 to 5 years.

how to make DUPLICATE PATTERNS with epoxy resins

Fig. 1. Plastic pattern removed from the mold. Should additional patterns be needed, the same mold can be used over and over again.
Photo courtesy The Crane Company

By Steven P. Kish

President
Kish Industries, Inc.
Lansing, Mich.

MASS PRODUCTION TECHNIQUES in modern foundry practice require many duplicate patterns in the shortest possible time. Preferably, such duplicates should be prepared by semiskilled labor, keeping training time and problems to a minimum. At the same time, molds for precision castings of all sizes require patterns that are strong, smooth and abrasion resistant, permitting repeated use of the same pattern. A pattern material low in shrinkage is desirable because it avoids guesswork and refinishing after the pattern is cast.

For quite some time, plastics such as phenolics have been applied to pattern casting because they offer several advantages over metals. Less machining equipment is needed, reducing capital investment, and lower weight simplifies handling. Most important of all, the time required to make patterns with plastics, *Fig.* 1, is about half that needed with metals.

However, several factors limit the use of phenolics. The acid hardeners required are corrosive to metals. Phenolics chip and crack with handling and weathering, and their impact resistance is relatively low. Also, in larger patterns, shrinkage becomes a problem. Finally, high-temperature cures are necessary to obtain the required strength.

To overcome these difficulties, epoxy resin formulations have been developed that are versatile in application and lead to successful pattern fabrication. These formulations offer many advantages.

While curing, the epoxy formulation shrinks only about 0.0001 inch per inch and, for all practical purposes, duplicate patterns are the same size as originals. Due to the low shrinkage of epoxies in curing, internal stresses and warpage are avoided. Additional material may be easily fused to a cured pattern, resulting in a smooth, strong and unmarked joint. Also, cured epoxy resin patterns can be machined without chipping or spalling. The cured resin surface being smooth does not pick up sand, permitting easier draws and less hand slicking. Epoxy formulations used for patterns generally have a Barcol

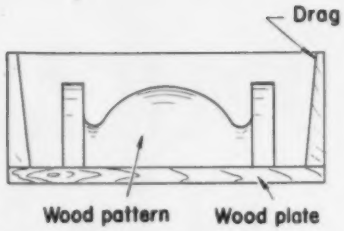


Fig. 2. The pattern is mounted in a drag.

hardness of 65 to 70 and offer high abrasion resistance. Cast epoxy resins have about twice the flexural, tensile and compressive strengths of cast phenolics. Still higher strengths are achieved when the epoxy resin is laminated with glass cloth. Typical strengths are: flexural, 45,000 psi; tensile, 30,000 psi; and compressive, 42,000 psi.

Materials Used

Three formulations, based on Shell Chemical Corp. Epon epoxy resin, are frequently used. One (Kish #316) is for laminating with impregnated glass cloth; the second (Kish #361) is used to cast cores, and the third (Kish #312) is a hard-surfacing formulation.

Epoxy resin formulations and curing agents are available to fit most pattern requirements. Patterns of almost any size can be cured at room temperature. Several curing agents or hardeners are used with epoxy resins and, by varying the amounts of curing agent and resin used, properties of the cured casting can be adjusted to meet special requirements. Values of hardness, impact strength and flexibility can be varied. Pot life, the time it takes for a mixture to set, can be extended and viscosity may be varied to facilitate laminating complicated fillets and corners.

Pre-impregnated glass cloth is used with the laminating formulation to build mold and pattern shells. These forms, which add considerable strength to the pattern, are then backed and filled with core formulation. Glass cloth is available in a variety of weights and weaves. Many layers of a light cloth, such as No. 128, are preferred for patterns having many fins and sharp corners. Patterns ranging from small globe valves to large boiler sections have been made satisfactorily with glass reinforced epoxy resins.

Making the Pattern

The original pattern is mounted in a drag, *Fig.* 2, and the seams and joints are caulked. A parting agent is applied. The laminating formulation, mixed with hardener, is brushed over the pattern and drag. After the formulation has started to set, another coat is brushed on. Several layers of resin pre-impregnated glass cloth are draped over the pattern and drag, *Fig.* 3, until a sufficient thickness (about $\frac{3}{16}$ inch) is built up. Since this formulation will gel in about 25 minutes after hardener is added, large quantities should not be prepared. The core formulation and hardener are heated separately to 150 F and then mixed. The mixture is then poured over the cloth-resin laminate, *Fig.* 4, covering the highest part of the pattern to a minimum depth of 1 inch. The mold cures in about 24 hours.

After curing, drag is inverted and the wooden board and original pattern are removed, *Fig.* 5. The finished plastic mold can now be used to make any number of duplicate patterns.

The mold is polished, and a parting agent applied,

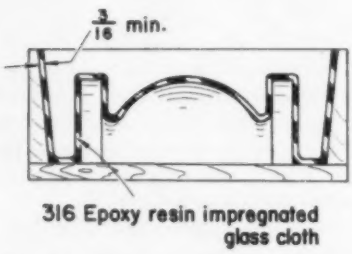


Fig. 3. Pattern is covered with impregnated glass cloth.

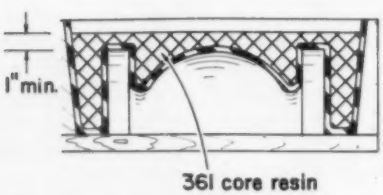


Fig. 4. The core formulation is poured over the resin laminate.

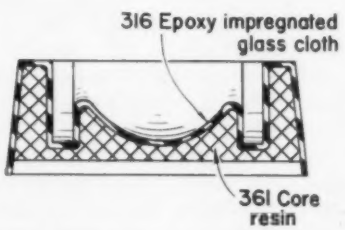


Fig. 5. The drag is inverted and pattern removed.

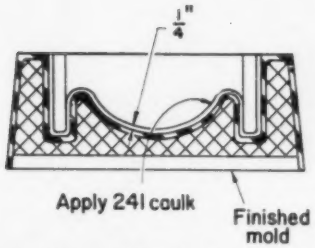


Fig. 6. After polishing, a layer of caulking is applied.

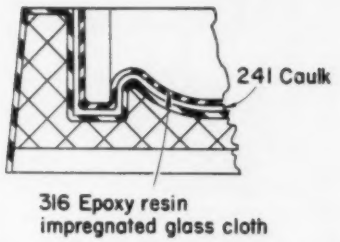


Fig. 7. Impregnated glass cloth and resin laminate is built over the caulk.

before coating with a layer of caulking compound ¼ inch thick, *Fig.* 6. This is followed with more parting agent. Later the caulk will be removed, providing a space to be filled with surface casting resin. A pre-impregnated glass cloth and resin laminate is built over the caulk layer, *Fig.* 7. Before this is done a few small holes are dug in the caulking, spaced around the mold. The holes will be filled with formulation to form locating pins and are needed to space the pattern after the caulking has been removed and before the surface resin is cast.

After the laminate has cured, more core formulation is mixed and poured into the cavity, filling it up, *Fig.* 8. The mixture is cured as before.

Cleats, screwed into core material, *Fig.* 9, are attached and the partly finished pattern is removed from the mold. The mold is cleaned of all caulking compound and old parting agent, and new parting agent is applied. The unfinished pattern is rough sanded to achieve a good bonding surface and replaced in the mold. The locating pins formed earlier assure proper positioning.

The space made by removal of the caulk is completely filled with the surface casting formulation, slightly above the level of the mold. After 12 hours, the finished pattern is removed, *Fig.* 10.

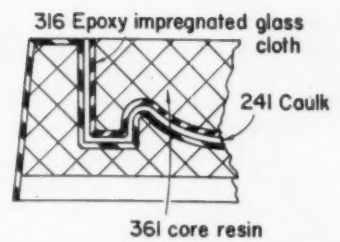


Fig. 8. Core formulation poured over the laminate fills the cavity.

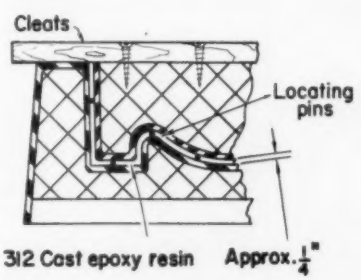


Fig. 9. Cleats are screwed into core material to ease lifting.

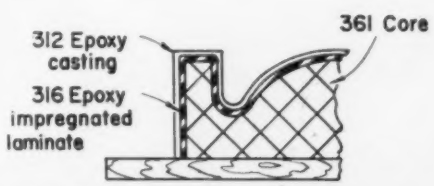


Fig. 10. The finished pattern is removed.

Summary

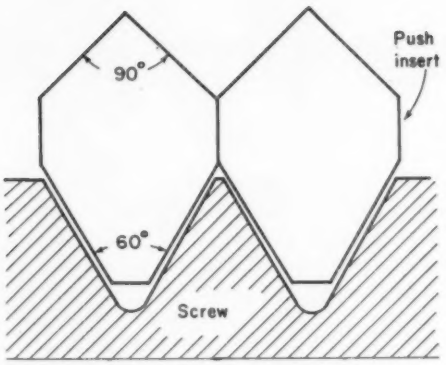
From the experience of several foundries and large industrial concerns, it is evident that epoxy patterns offer large savings in time and money. Ease in handling and storing both the raw materials and the finished molds enhances the use of epoxies in mass production. Such resin formulations and hardeners may be stored for one year in airtight containers without deteriorating, and finished molds and patterns may be kept outdors almost indefinitely without danger of cracking or distortion due to weather. In addition, as many duplicates as desired can be made from the same master mold, and users report thousands of castings produced from a single epoxy pattern.

designed for

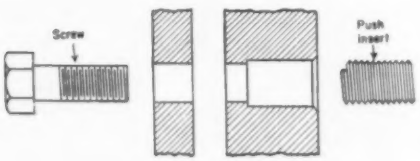
PRODUCTION

Screw Thread Inserts Installed Without Tapping

Until recently, it has been necessary to tap internal threads in a hole to receive a threaded member. Inserts developed by Heli-Coil Corp., Danbury, Conn., are merely pushed into straight-sided plain holes to provide wear-resistant female threads in nonstructural parts at low cost. Holes can be drilled or, with die castings, cored. Inserts are applied by a straight push without rotation. Insertion can be power assisted and have any degree of automatic operation required by the application.

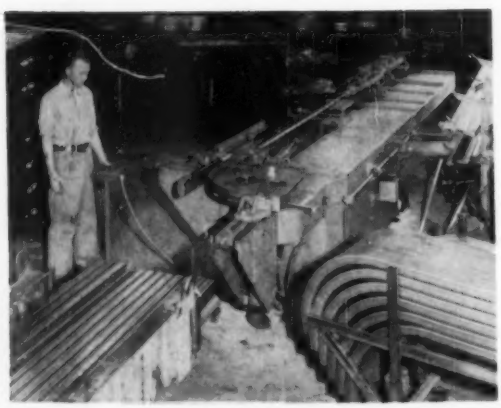


PUSH INSERTS are manufactured from wire coiled in helix. Coils are tightly wound with adjacent coils in contact. Flat surfaces on sides of each coil prevent coils from slipping over each other during insertion. Internal threads on the inserts are 60 deg and external threads are 90 deg. A runout thread on the threaded member automatically anchors the insert in the hole by wedging the top coil into the piece part. Inserts can be held in soft metals by upsetting the metal around the hole.



INSERTS can be installed from the back of a part by providing a retaining shoulder. This shoulder can be obtained by counterboring or step drilling, or by coring into die castings or molded parts. Pip push inserts are made of any material that can be formed into wire.

One Set of Tooling Makes Right and Left Track Bends

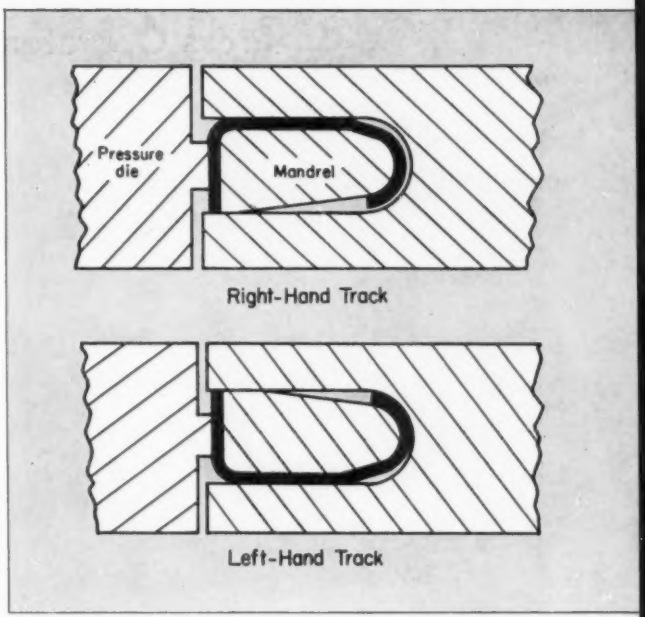


Both right-hand and left-hand tracks for overhead garage doors are now made on a bending machine without any tooling changes. Tracks of both hands have 90-deg curved sections of equal radii and angles.

Formerly, Barber-Colman Co. purchased formed track, requiring considerable inventory and storage space. The new production method eliminates these

BENDING MACHINE at completion of a 90-deg bend. Bends are formed in HR 12-gage steel channels, 1 by 2 3/32 inches, on an inside radius of 15 inches. Tracks are slightly over 9 feet long. Tooling setup is such that the 8-foot leg need not be swung.

problems. With a rolling mill, a slitter and a Pines Engineering Co. bending machine, Barber-Colman now makes their own track as needed from flat stock. Stock is slit and then roll formed from the flat. Depending on the direction of bend, track can be either right or left hand. Production costs have been reduced from 15 to 20 percent and operators, who normally run other machines, can bend track sections as needed.

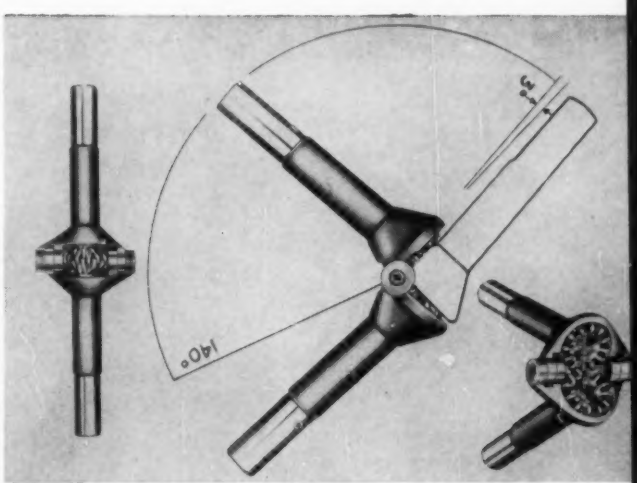


TOOLING is designed so bends can be made in right-hand track with the channel opening down and in left-hand track with the opening up. No changes are required in the dies, mandrel or clamping plug.

Remote Control Power Train Operates Through Wide Arc

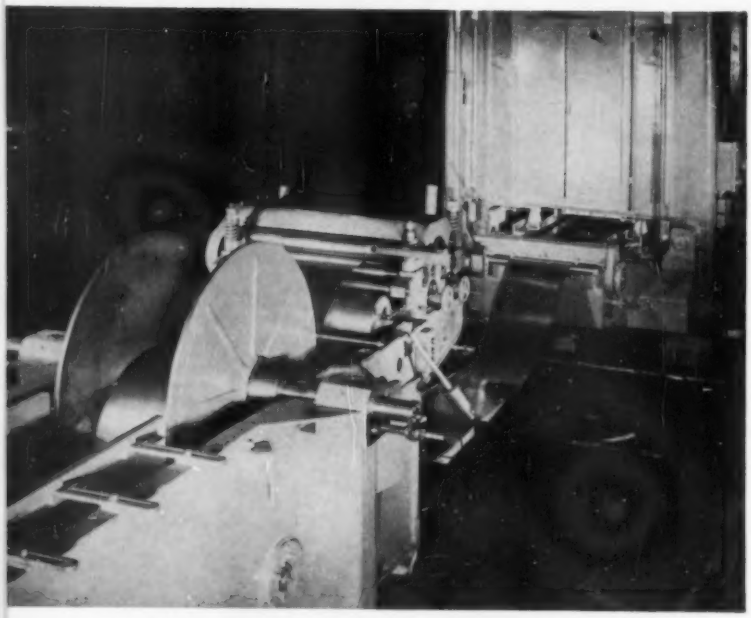
Need for remote control of machine tools, processing equipment and laboratory test devices is creating new interest in a power transmission unit that has remained comparatively unknown for many years. Subject of this growing interest is a hinged gear joint now produced by The Gray & Prior Machine Co., Hartford, Conn. There is no need to shut off or reduce the speed of this power transmission when swinging from any position to any other.

Primary link in its power train are two specially designed bevel gears that have been modified to mesh smoothly and consistently through the full 137-deg arc despite a constantly changing relationship between the pitch line and the axis of each year. The power train can transmit constant torque without the whiplike speed changes characteristic of a universal joint.



THREE VIEWS of the hinged gear joint graphically illustrate its ability to transmit power around corners. Photo at left shows joint with input shaft almost doubled back on output shaft. Photo on right shows joint in extended position with shafts deviating only 3 deg from a straight line. The line diagram superimposed on the center photo indicates the range of motion of the joint. At least two gear teeth remain engaged even when the joint is taken to full angle of transmission. In extended position, all gear teeth are meshed.

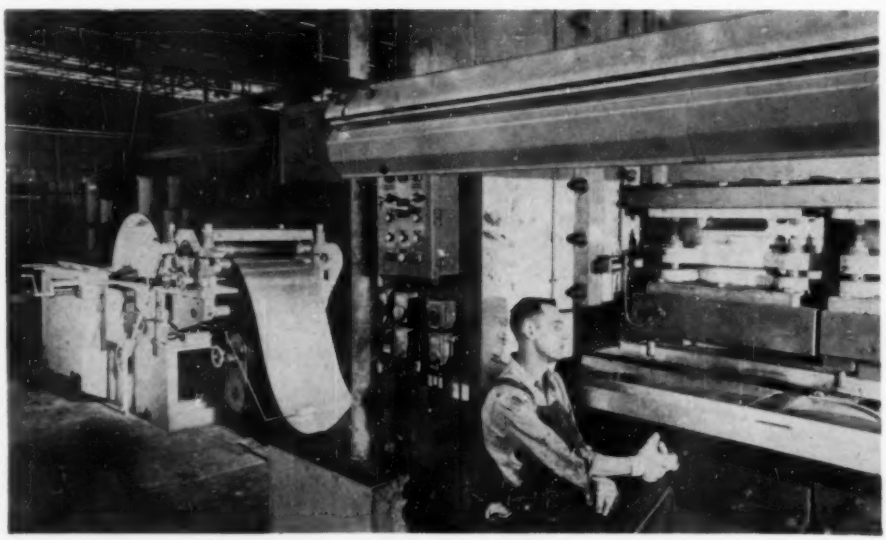
Press Operates in a System Not as a Single Production Unit



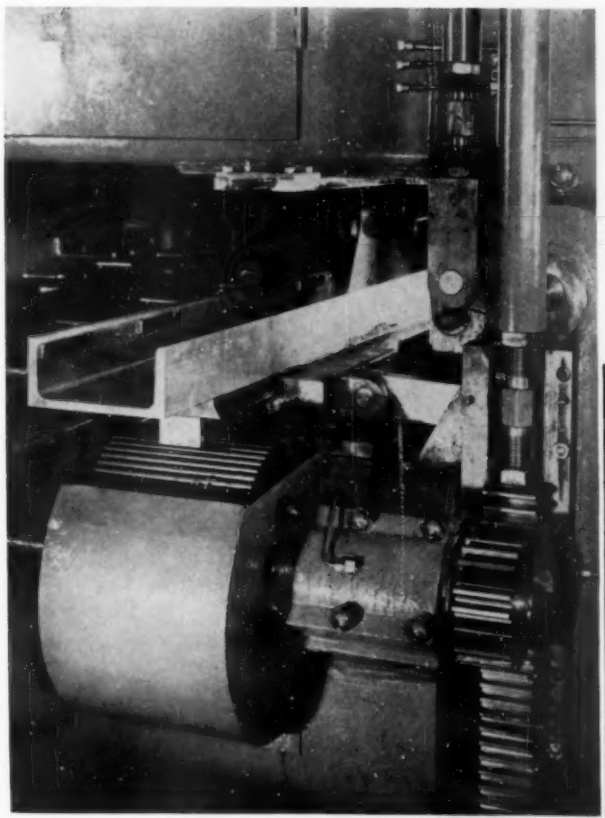
COIL CRADLE and straightener deliver stock to the roll feed, attached to the press, which synchronizes delivery with the press stroke. A second coil is held on a tilt table to reduce handling time between coils.

Standard mill coils weighing up to 6,000 lb are delivered to a powered coil cradle at the entry side of a transfer feed press, and twelve deep-drawn refrigerator crisper pans per minute drop onto the exit conveyor. In between, are a five-roll straightener, a synchronized roll feed and the seven stations of the press. The installation is located at General Electric, Louisville, and the press is a 700-ton E. W. Bliss.

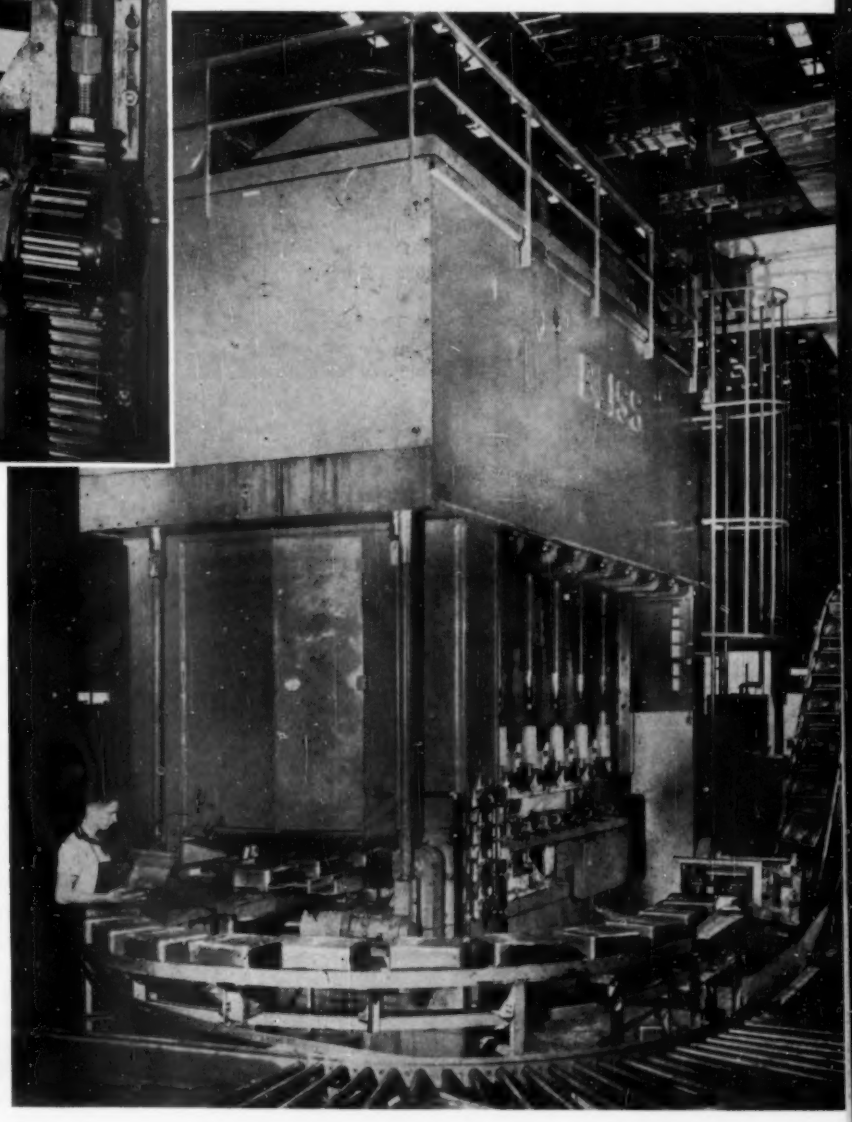
Two channel bars extend the full length of the press. Feed fingers are bolted to these bars. Two pairs of driving mechanisms, one on each end of the press and linked by yokes to the main shaft, control movements of the channels. One pair directs their lateral movement and the other pair directs in-and-out movement. Since the drive is taken from the ends of the shaft, there is no danger of the feed drive being out of time with the press slide.



AFTER OPERATOR threads the end of a coil through the straightener and the feed, operation is automatic. Press operations are: cut-off and draw, rough trim rear half of flange, rough trim front half of flange, cam form sides of pan, cam form front recess and pierce two holes in sides, curl rear flange and form indentations in side flanges, and finish trim flange.



FEED DRIVE mechanism with the cover removed. All four corners have the same arrangement. The large rack pinion gear is driven by the smaller gear and rack which, in turn, is driven by a cam and yoke arrangement on the end of the shaft. Cam and yokes on each end of the press have their own separate lubrication systems.



REFRIGERATOR crisper pans are automatically fed out of the transfer press onto a conveyor. Completed at a rate of 12 per minute, pans next go to the pickling and enameling.

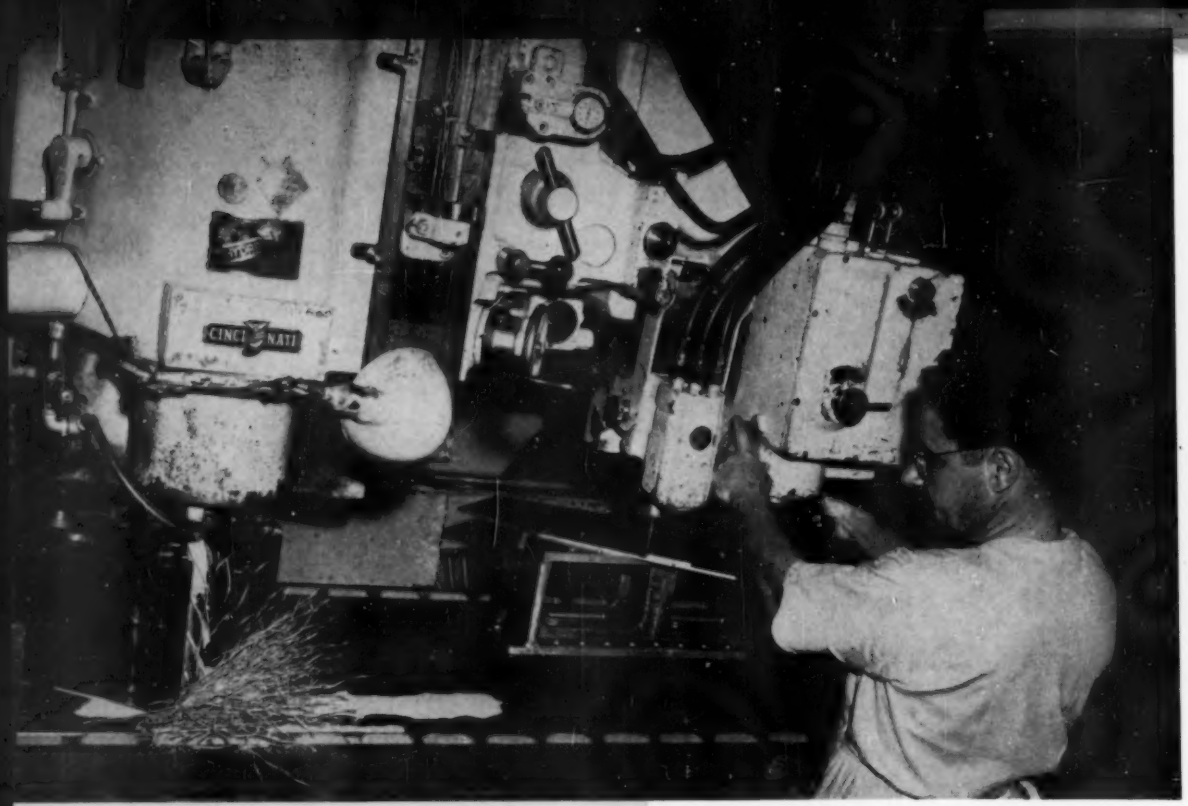


Fig. 1. After the center-to-center distance has been established, the milling machine can start to work on the part. Subsequent templates can replace the original one without the need for a complete setup.

Auxiliary Bolster Plates *Increase Machine Utilization*

By E. J. Van Wagner*
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and
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AUXILIARY BEDS or bolster plates have raised actual cutting hours over 30 percent for a group of Hydrotel mills. Increased cutting time is available because setup men can make workpiece and template setups on the bolsters away from the mill while the machine is cutting previously loaded work, *Fig.* 1.

These vertical, template-controlled mills are used to make production parts for aircraft, to prove and complete new tooling setups, and to produce limited numbers of parts with a minimum of auxiliary tooling. When it was realized that 81 percent of the available cutting time was being expended on intricate setups for short runs, tool design engineers were called in to try to increase utilization. Results of their efforts not only effected savings in unproductive machine time but provided auxiliary tooling beneficial for all uses of the machines.

***Senior member ASTE Long Beach Chapter.**

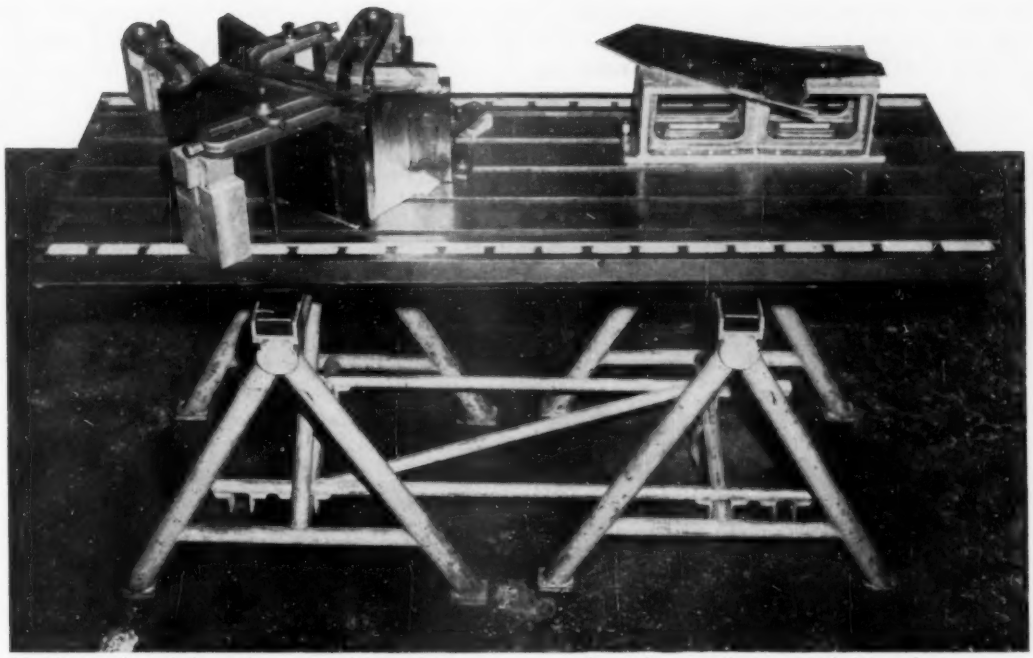


Fig. 2. Auxiliary bolster plate set up for mounting on a vertical milling machine. A standardized template base and index pins support and locate the template on the right. Stands support bolster plates at comfortable height for setup. Correct positioning on the auxiliary bed plate insures correct machining.

Basic reasoning indicated that the only way to increase available machine cutting time was to achieve another method of making setups. This resulted in the design and fabrication of bolster plates and additional auxiliary tooling such as standardized template bases, special template setup pins, work stands and a manually controlled overhead crane system.

Bolster plates, *Fig.* 2, were cast of ASTM 40 grey iron for stability and economy. Cross section of the bolster was designed to keep weight at a minimum but to provide sufficient strength to resist probable stresses. Plates now in use have finished dimensions of 28 by 79 inches and are 6 inches in height. Patterns and cores used to make them establish a module of 8 inches so the length of future castings can be increased or reduced in multiples of that increment. Table length of the mills is 119 inches.

Standard T-slots are milled in the top of the bolsters to exactly duplicate size, location and spacing of the slots in the machine beds. They are machined to be parallel to a reference edge which is the bottom lengthwise edge of the casting. Tolerances are $\pm$ 0.0015 inch for the full length. Parallelism between the top and unslotted bottom of bolsters is held to 0.003 inch for the full length.

It is necessary to key the bottom surface of the bolster because of the precise reference line that is machined on the lengthwise edge. During setup, the bolster plate is slid into position against keys dropped into the inside keyway of the mill bed. Bolsters are secured to the machine bed with toe clamps using either special T-bolts or a cap screw and T-nuts. The bolster plate's keyways can be considered a precise extension of those of the machine bed when the bolster is thus located and secured on the machine. Precision fabrication of the auxiliary bolster plates enables setup men to achieve precise setups that will assure accurate work by the milling machine.

Formerly, each profile template carried its own base. Manufacturing of bases required some time and bases were not interchangeable. Large storage areas were required for these bases. Template base storage space is now unnecessary and future manufacturing time for individual bases is avoided.

Template bases, *Fig.* 2, became part of the bolster plate package as an auxiliary aid. Their usefulness, however, extends through all operations performed on these milling machines. Template bases are cast aluminum, cored so they are light enough for one man to carry easily. All template bases are 7 inches high. Various lengths, in increments of 10 inches, can be cast from the same pattern. If the workpiece is high, a base is mounted on the bolster plate to bring the profile template to the stylus height. If no bolster is used, two bases can be stacked under the template to establish it at the correct height.

Parallelism of the top keyslot and reference edges

is held to close tolerance with the lower keyslot of the template bases. Thus, the top keyslot is an extension of the keyslot in the bolster plate or mill bed.

The index pin assembly is a precisely made T-key that is a slip fit into the keyways of the mill bed, the bolster and the template bases. The index assembly has a locking screw that secures it at proper position in the slot and various length pins can be locked at the proper height above the surface.

In operation, the setup man slides an index pin in the keyslot to any preselected longitudinal distance from the index point of the workpiece. This is the primary index pin. The primary index hole in the template corresponds to the same reference point in the workpiece.

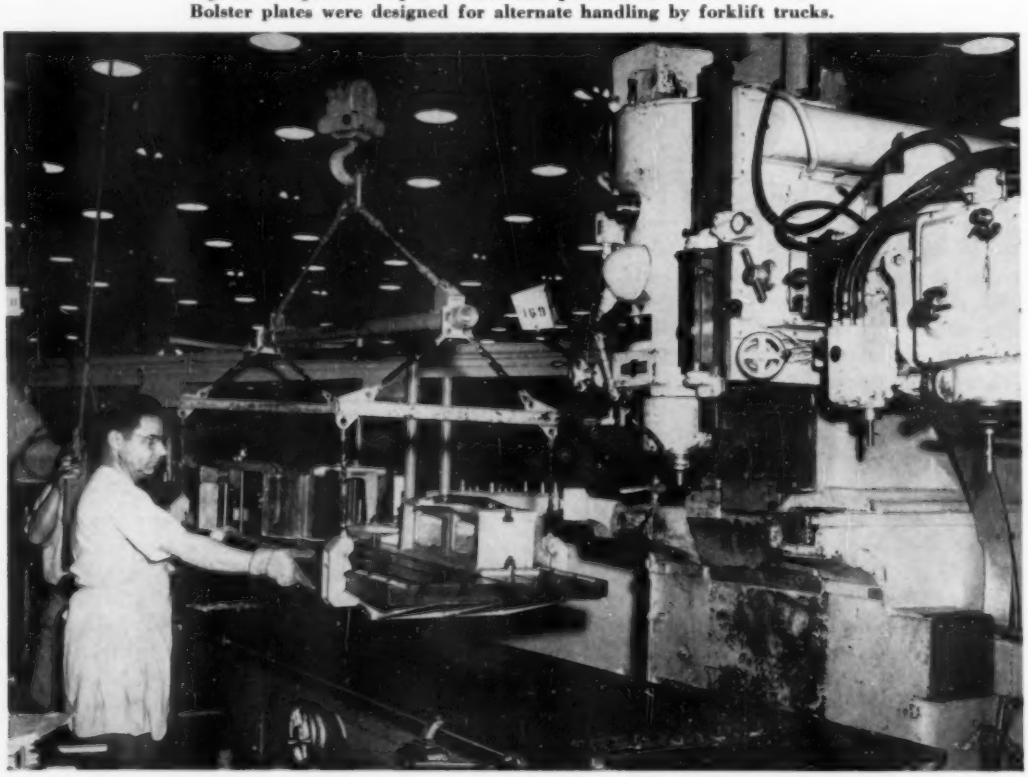
The secondary index hole in the template slips over a second index pin which does not have to be locked in place. The center distance is of no importance. This second index pin establishes the radial location of the template relative to the radial location of the workpiece. When several templates are required to finish one workpiece, they are indexed on the primary pin. This insures proper orientation between the various templates and the workpiece as milling of the shape progresses.

When a setup is complete, a manually controlled overhead crane, with four-point suspension lifting hooks, is used to raise the bolster assembly from the stand and transport, *Fig.* 3, it to the machine. Sides of bolsters have been cored so a forklift truck can transport the setup bolster. The bolster is slid to the reference parallels, checked and secured in position. When the cutter spindle and stylus spindle are located for center-to-center distance, work is started, *Fig.* 1.

After work has begun on the new job, the previously used bolster can be disassembled. This bolster can then be set up for the next job. Down time is kept to a minimum during transfer of bolster plates. At least two bolster plates are required for each mill to prevent delays. Template bases and index assemblies are stored in sufficient numbers so there is never any delay because of lack of these auxiliary aids.

Result of adding this auxiliary tooling is a possible gain of 1246 cutting hours per mill per year based on a two-shift schedule. Such auxiliary tooling is inexpensive to produce, since it need be made only once, when viewed in terms of increased available machine cutting time. Future economies appear to be promising as a result of variations in the basic idea. Properly designed auxiliary machine beds may also increase utilization of other production machines.

Fig. 3. Completed setup is lowered into position on the machine table. Bolster plates were designed for alternate handling by forklift trucks.



Evaluating and Testing Machine Tools

By Max Kronenberg*

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Now that machine tool replacement is being considered a science, tool engineers should be prepared to furnish sound data on which financial decisions can be based. The author draws on an extensive background to outline methods for conducting tests and evaluating machine performance.

INDUSTRIAL MANAGEMENT is becoming increasingly interested in machine tool replacement and methods for evaluating machine tool performance. Although final decisions are financial, good replacement programs evaluate data on many direct-cost factors that were not previously considered. Evaluation of machine tool performance now includes comparisons of speeds and feeds, traverse rates, strength, rigidity, vibration, power, thermal expansion, setup time, handling time and possibility for attachments. Maintenance is one of the most important nondirect costs considered for both present and proposed machines.

Factors that appear to have little effect on finance actually are important in machine comparisons. Quality control, for example, seems remote from costs but has much to do with production expenses. Also, if a new machine can produce a surface that requires no secondary finishing, considerable time and expense can be saved. This one factor could result in savings sufficiently large to justify purchase of the equipment. Estimates of service life and salvage value also are important considerations in evaluation of machine tools.

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Although not necessarily related, the development of test equipment, *Fig.* 1, and interest in machine tool evaluation have kept pace. Strain gages, oscilloscopes and multiple-channel recorders, for example, enable the gathering of more, better and simultaneous data. These, and other test instruments, can be used for determining performance for both cutting and forming machines.

A by-product of machine evaluation has been the development of better acceptance and classification procedures. By periodically classifying production tools into accuracy groups, jobs can be assigned intelligently in the plant and scrap can frequently be avoided.

Although deflection, vibration and thermal distortion are interdependent to some extent, it is more convenient to consider them separately.

Thermal Distortion: Distortion increases and decreases according to machine loading and ambient

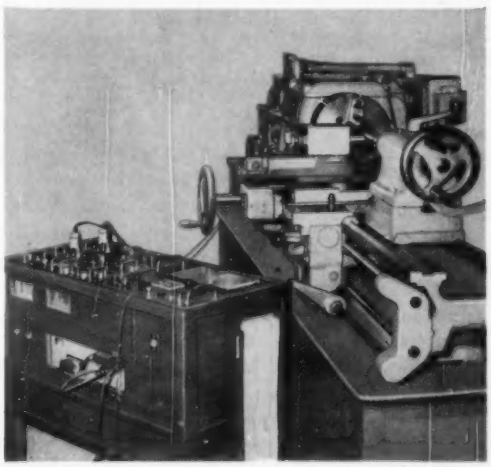


Photo courtesy the Sanborn Co.

Fig. 1. Machine tool tester results in vibration records that can be read without need for development.

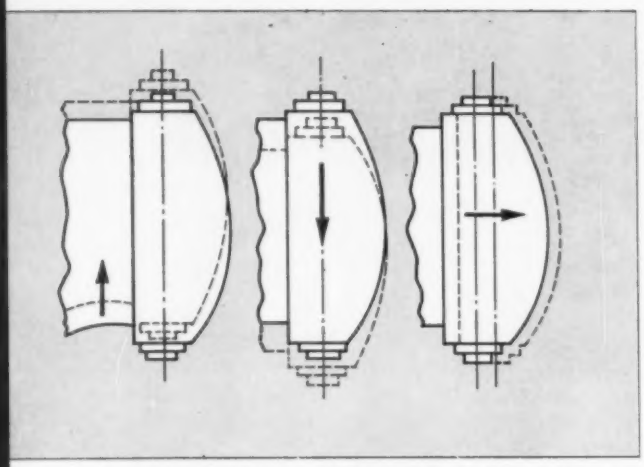


Fig. 2. Movements of spindle carrier resulting entirely from thermal changes. Column head movement is upward whereas the spindle carrier movement is downward and outward.

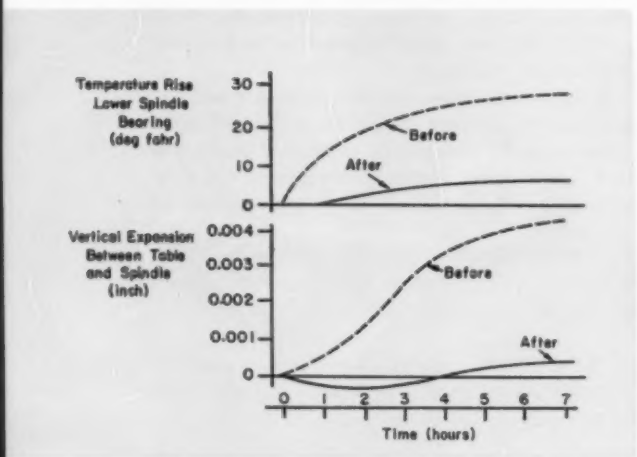


Fig. 3. Temperature rise and expansion characteristics before and after improvements to vertical milling machine. Both tests run at 450 rpm.

conditions. Largest temperature differentials and distortions usually occur during first two hours of warm up. Thermal expansion has become more important with higher spindle speeds, and the possibilities of making scrap are greater. Automatic in-process inspection or control of workpiece size can minimize scrap but it is most important to know how a production machine reacts to changes in temperature. In any test for thermal distortion, temperature rise should be measured so the interrelationship can be determined. Tests are usually made on idle-running machines but loads to simulate machining conditions can be applied.

Thermal expansion between the spindle and table of a vertical milling machine takes place in three major directions, *Fig.* 2. Heat developed in the column causes an upward movement of the head and spindle carrier. Heat generated in the spindle carrier causes the spindle to move downward. These movements balance to some extent but do not necessarily occur at the same time. The spindle may slowly rise and then drop again until a condition is reached where the spindle only rises. This irregular rise usually occurs during the first two hours of operation of a vertical machine. With horizontal milling machines, spindle movement is more uniform. In addition to these two movements, the spindle consistently moves away from the column face toward the operator's station.

Temperature rise and expansion are shown for a vertical milling machine in *Fig.* 3. Double curves indicate conditions before and after improvement of the machine. Temperature increased 30 deg Fahr during a 7-hour period and ultimate expansion was 0.004 inch. Improvements to the machine included changing the type of bearings, replacing grease lubrication with oil, trying different grades of oil and reducing amount of oil supplied. Final temperature rise was only 6 deg Fahr in 7 hours with an ultimate expansion of 0.0006 inch. Reductions were 80 and 85 percent, respectively.

All data for distortion tests are given in temperature rise rather than in temperature so that tests at different temperatures can be more easily compared. Usually, the temperature rise of the room is deducted from the temperature rise of the machine.

It is generally found that spindles of horizontal boring mills move consistently upward as temperature increases, *Fig. 4.* In the mill whose tests are shown, trouble was experienced when attempting to reduce the thermal expansion. The machine bored more accurate holes when it was cold than when it was warm. However, excessive vibration occurred when the machine was used without proper warm up. The main reason for this performance was found to be the front bearing in the spindle carrier assembly.

As shown in *Fig.* 5, lubrication of the cold machine was insufficient and metal-to-metal contact resulted. This condition resulted in self-excited vibration. After a warm-up period, no substantial metal-to-metal contact existed and no vibration was noticed but the spindle had risen and hole accuracy was poor.

In this instance, both desirable and undesirable effects accompanied machine warm up. In order to remedy this situation, a second oil inlet was placed on top of the bearing for lubricating the rollers when the machine is cold. In addition, the oil supply was reduced and spindle bearings were adjusted to reduce thermal expansion. Adjustment of such spindle bearings should be done while the machine is rotating. This requires specially designed equipment. Such equipment can also be combined with a device for finishing the bearings under load.

That distortion during the warm up of a machine has a high magnitude can be seen from tests on a turret lathe. With the machine running at 1000 rpm, temperature rise was about 30 deg Fahr during the first hour. During this time, the spindle moved 0.002 inch upward and 0.007 inch horizontally. During the second hour, rise was 0.0004 inch and horizontal movement was 0.0001. Because of the large vertical movements during the first hour of operation, drilling, reaming and similar operations resulted in serious errors. Holes were out-of-round by twice the amount of spindle rise. Scrap is unavoidable and time is lost resetting tools if the temperature rise is overlooked in a turret lathe.

Axial expansion, accordian effect, of the spindle and headstock of a lathe is of interest if accurate turning is to be attained and maintained. Simple tests at The R. K. LeBlond Machine Tool Co. show that the thermal expansion of the spindle in the axial direction can be kept to small magnitudes:

Speed (rpm)	Running Time (hours)	Axial Expansion (inch)
225	4.5	0.0005
300	1.0	0.0002

The effect of load on temperature rise can be illustrated by tests on a hydraulically driven broaching machine. In a broach, temperature rise causes a distortion in the column, which bends backward away from the operator position. Oil temperature in the test broach cylinder increased 18 deg Fahr in 7 hours when running idle. When a load of 300 lb was applied, temperature increased an additional 9 deg Fahr. The 50 percent increase in temperature rise caused by the load is less than occurs in some mechanically driven machines.

Deflection: Deflection of a machine tool under load is a measure of the rigidity of the machine. However, this deflection is much more complex than the deflection of a bar on a test stand. Deflection in a machine is complex because an assembled machine is composed of many parts with different fits. Deflection occurring between a tool and a workpiece should be of major interest to every tool engineer.

On a lathe, this deflection is a composite of the deflections of bed, headstock, carriage, etc. On a horizontal milling machine, the most important deflection occurs between the arbor and table. With radial drills, lifting of the arm as a result of cutting force is of major importance because too much deflection leads to inaccuracy and broken drills.

As a result of numerous tests to determine the relationship between load and deflection, it has been found that a hysteresis loop, *Fig.* 6, applies. The dotted line from the center to point *A* is obtained when applying a load and gradually pushing tool and work apart. Upon release of the load, the test indicator hand does not return to zero; it stops at point *B*.

Reversing the direction of the load by pulling tool and work together, results in the curve from *B* to *C*. When this load is released, the indicator hand does not go back to zero but stops at point *D*. If the tool and workpiece are again pushed apart with the same amount of applied load, the load-deflection curve will go to point *A* but by the *DD'A* path. This cycle can be repeated several times.

On the hysteresis loop, straight portions *BB'* and *DD'* are of particular interest. They indicate motion of assembled parts, not distortion. A load of a few pounds is sufficient to impart a large motion to the machine parts. This load need only be large enough to overcome friction between the parts. This friction must be overcome by a load in the reverse direction so that the indicator hand can be made to pass through zero. Backlash in gearing accounts for a large part of the relative motion between parts as load direction changes.

The stored energy of deflection will return a deflected part to its original state upon the release of load. It is sometimes difficult to determine which portion of a loop is due to deflection and which to

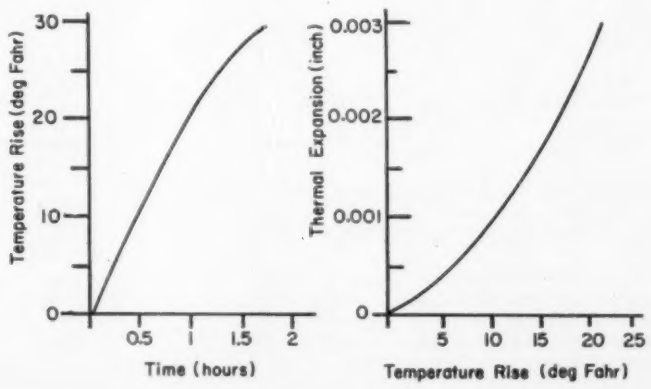


Fig. 4. Thermal distortion caused in a horizontal boring mill by rise in temperature. Mill was operating at 175 rpm.

motion since the straight portions of the loop may not always be distinct. The hysteresis loop is also a measure of damping in the system. In the case of vibration, such load cycles occur but at rates that could not be simulated by push-pull tests.

Rigidity of a machine, with regard to deflection, may be taken as the ratio of deflection to load. It is easiest to use 1000 lb as a reference load in making deflection tests. Distortion is usually designated as the total distance from *A* to *C*, *Fig.* 6. Where deformation and motion are to be separated, the vertical distance between *BB'* or *DD'* is subtracted to give the distortion.

On a broaching machine, the deflection between the column face and broach was found to be 0.0025 inch per 1000-lb load, applied parallel to the column face. This test simulated the cutting load component occurring on a tool with shear. Deflection between worktable and tool was 0.0047 inch per 1000-lb unit of load. Permissible deflection depends on the type of work being done.

Effect of milling machine gib tightness can also be seen from test data. With tight gibs, the hysteresis loop does not have any straight portions and the branches to right and left join each other. Deflection under a 1000-lb load was 0.0003 inch. Loosening the setscrews one turn, as recommended by the manufacturer, resulted in a deformation of 0.0012 inch, or 4 times larger. Loosening another turn resulted in a 0.003-inch deformation.

On a horizontal milling machine, the knee deflection was 0.0037 inch when feeding to the left under a 1000-lb load. When feeding to the right, deflection was 0.010 inch. Inspection of the machine showed that when feeding to the left, the load was directed against a solid dovetail. When feeding to the right, the load acted against an inserted dovetail. By replacing the screws of the inserted dovetail with tightly fitted dowel pins, deflection was substantially reduced.

In addition to deflection in the machine, it is necessary to consider deflections caused in the workpiece by the cutting force. The upper sketch in *Fig.* 7 shows the three components of a cutting force. The vertical force, F_v, is usually the most significant one as far as power, gear torgue, etc., are concerned but has practically no effect on the deformation of the workpiece. It is an exception when workpieces are crankshafts or others where torsion during cutting has considerable effect. The horizontal force, F_l, acting in the direction of feed, may also be disregarded in connection with workpiece deformation. The horizontal force, F_r, acts radially and is responsible for most deformation.

The workpiece diameter will be larger at middle by an amount, *e*, equal to twice the deflection, *f*. The increase in diameter can be calculated by using a formula based on the deflection of a beam.

If a radial cutting force of 1000 lb is assumed, it can be shown that steel bars with the following approximate dimensions would be 0.002 inch heavier in the middle than at the ends:

Diameter (inch)	Length (inch)
2.00	10
3.25	20
4.50	30
5.50	40

In addition to indicating the changes in dimensions that will occur, practicable formulas can be used to determine the positions at which steadyrests should be set when turning or grinding slender shafts. Comparison of the machine and workpiece deflections will often reveal information about the most efficient method for reducing undesirable deflection. It is often advisable to select high speeds

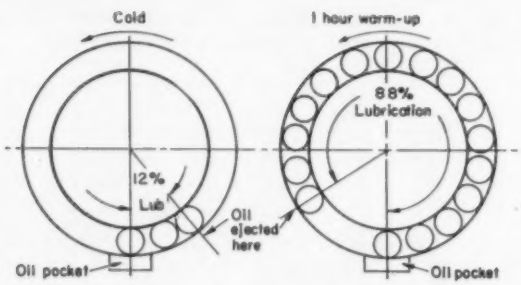


Fig. 5. (above) Front spindle bearing lubrication cold and after warm up. Cold bearing chattered, warm bearing was inaccurate.

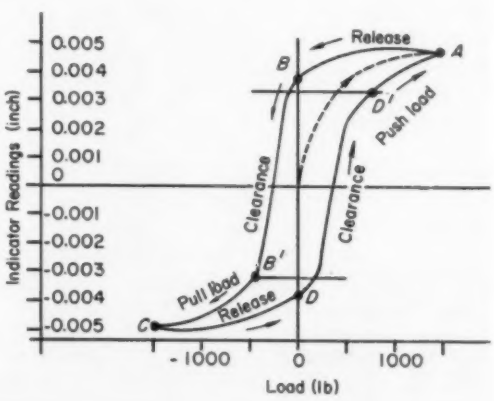


Fig. 6. (right) Push-pull deflection test results for an assembled machine indicate considerable movement, straight sections of hysteresis loop, between parts. Deflection occurs during curved sections of loop.

and low forces to reduce deflections—even if cutting time may be increased slightly by so doing.

Vibration: Whether it is perceptible or not, vibration is frequently the cause for poor tool life, damage to machine parts, excessive down time, damage to workpieces and poor surface finish. In addition, vibration affects the strength of foundations resulting in early deterioration through fatigue. This is particularly true when machines are used on upper floors. Vibrations in all phases of engineering follow the same principles but those encountered in machine tools are frequently self-excited.

Machine tool vibration can result from unbalance in rotating parts, faulty bearings, excessive tool overhang and jerky movements of tables in reciprocating machines. Uneven motion can be caused by friction or faulty design.

Most important, vibrations can frequently be caused by deflection of beds, knees, overarms, gear boxes, headstocks, tailstocks, columns and tables. Housings are usually thought of as covers for power transmitting elements but they have to withstand forces and are subjected to stress variation that may lead to vibration.

Research into the distribution of metal in these machine parts and the effect on vibration of such distribution is being carried out. Results of such experimentation will lead to new designs with greatly improved resistance to vibration.

Inaccuracy in the engagement of gears and wind-up in shafts are also responsible for vibrations. A shaft having a keyway on only one side may vibrate due to periodic changes in deflection as the shaft rotates. A splined shaft is less subject to such vibration.

It is not yet possible to say definitely what amplitude of vibration is permissible in a machining setup. Frequencies are usually more important than amplitudes because stresses set up in tools or machines increase with the square of the frequency but are only directly proportional to the amplitude. As far as fatigue of machine parts or cracking of carbide tips is concerned, primary consideration should be given to a determination of frequencies being generated in the setup.

Both self-excited and forced vibrations have significance in tool engineering. Humming of telephone wires, an audible indication of vibration, is caused by the steady force of blowing wind. Although the wind is not an oscillating force, it can produce vibrations. Frequency of these self-excited vibrations depends only on the dimensions and physical properties of the wire. Self-excited vibrations are at the natural frequency for the object. The natural frequency is the most severe. Similar conditions exist in many metal-cutting operations. In dry turning, for example, the workpiece reacts to the steady force of the cutting tool as does a wire to wind.

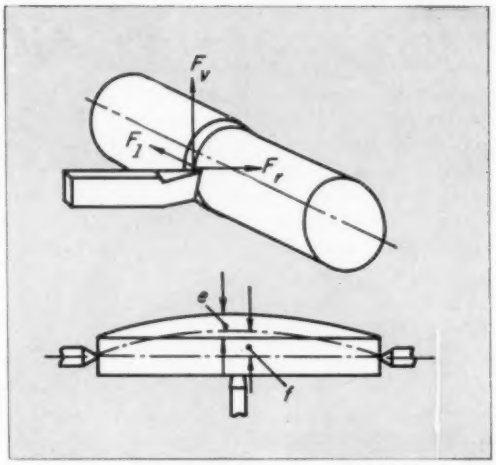
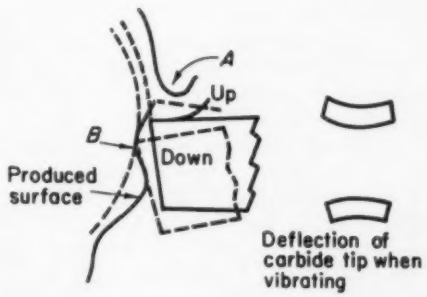


Fig. 7. Cutting forces that occur during turning, top, and a sketch of the effect of the radial force.

Forced vibrations result from the periodic change of a force, such as the periodic compression of material and separation of a chip. Formation and vanishing of a built-up edge can be cyclic and cause forced vibrations. Chatter marks from a preceding turn of the workpiece may force vibrations. The mechanism of a machine may come into resonance with the cutting force and result in heavy vibrations.

In practice, self-excited and forced vibrations frequently exist simultaneously. A lathe tool, for example, may be subjected to the forced vibration resulting from chip formation, and self-excited vibrations resulting from friction between tool flank and workpiece. Friction between chip and tool face may also generate self-excited vibriations. It is not yet positively known whether chip formation is the consequence or the cause of vibration.

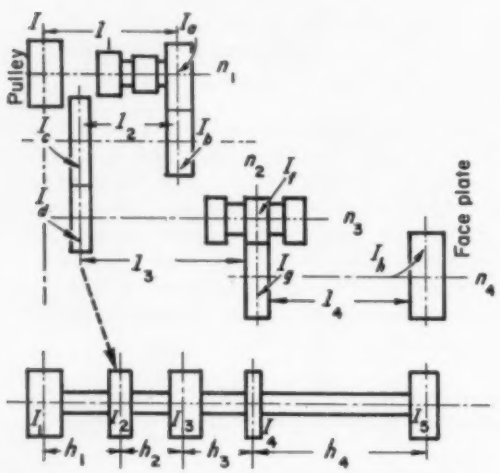
Fig. 8. Sketch of the vibratory motion of a tool point and the chatter marks that result on the workpiece.



A case of self-excited vibration in a cutting tool is illustrated in *Fig.* 8. Full lines indicate the neutral position of the tool. Dotted lines indicate limits of tool deflection and the wavy path represents the chatter mark produced on the workpiece. When the tool is in midposition, moving downward, it is taken along by the work. The friction force between them must be great or the tool would not go along. The speed difference between work and tool must be small. When the tool is in midposition on the way up, the friction force, though substantial, will be smaller than before and the differential speed will be larger. At the midway position in both directions, the friction force is high and energy is fed into the system. This energy will cause more and more vibration, a criterion of self-excited vibrations.

Self-excited vibrations are more easily generated when the cutting force reduces as the speed increases. With sintered carbide tools, such a drop in cutting force is found for speeds below about 100 sfpm. Poor service life of carbides at low speeds may well be a consequence of self-excited vibration.

Fig. 9. Method of obtaining natural frequency of torsional vibration of gear trains showing the mass and elasticity relationship between elements of the train, top, and the equivalent system.



In a milling machine, the threshold of vibration is related to the magnitude of the vertical cutting force component, i.e., the component that either pushes the work down on or lifts it up from the table. If this force is zero or small, instability exists and vibrations can be generated. For a given machine and setup. the relationship for the threshold of vibration can be expressed by a formula taking into account the feed rate, f_m, the depth of cut, d, and a constant, c, for the machine.

Such a formula indicates that the permissible feed rate for freedom from vibration is inversely proportional to the cube of the depth of cut. A slight reduction in depth of cut permits a large increase in feed rate without vibration. Taking two equal cuts instead of one permits eight times the feed. The amount of metal removed per minute is therefore four times as great. High production without chatter can best be attained by sweeping over the work with large mill feeds and small depths of cut.

It is common practice to look for unbalanced motors, faulty bearings and poor gear engagement as causes for vibration, but in addition it is necessary to investigate the vibrations caused by faulty mass distribution in other machine parts. Vibration that originates in parts remote from the cutting edge may affect tool life and surface finish when it combines with self-excited or forced vibrations at the cutting edge to result in resonance.

One of the main causes of belt vibration is the splice, and the tension side may act like a violin string to cause vibrations. Formulas are available for determining vibration due to belts and chains. Ball bearing vibrations are complex and tied up with lubrication and thermal distortion. However, depressions in the outer or inner race or high points which the balls strike periodically may lead to vibrations. Vibrations in gears are due to eccentricity, errors in machining, unbalance, shaft deflections, high points and dirt. A number of formulas exist from which such vibration frequencies can be calculated.

In addition to the lateral vibrations previously discussed, torsional vibrations can occur. These vibrations result from the distance between the center of rotation and the lathe tool or blade of a face milling cutter.

Such vibrations are transmitted to the gear train and may come into resonance with the vibration of chip formation. They are complex and difficult to analyze in machine tools because there are so many fundamental frequencies in machine tools. Masses in a machine tool headstock, for example, change whenever the spindle speed is changed because different gears come into engagement and different shafts transmit the power.

For the calculation of the natural frequency of torsional vibration in machine tools, the following procedure has been developed.

1. Prepare a sketch, *Fig.* 9, of the gear train showing the engaging gears for the speed setting to be studied.
2. Replace gears by inertia masses.
3. Unite the engaging masses into equivalent masses as a function of their speeds, n.
4. Determine equivalent shaft length.
5. Sketch equivalent system, bottom *Fig.* 9. The natural frequency of the gear train can then be calculated by the Holzer method or an approximate but simpler method.
6. Repeat same procedure for other spindle speeds.

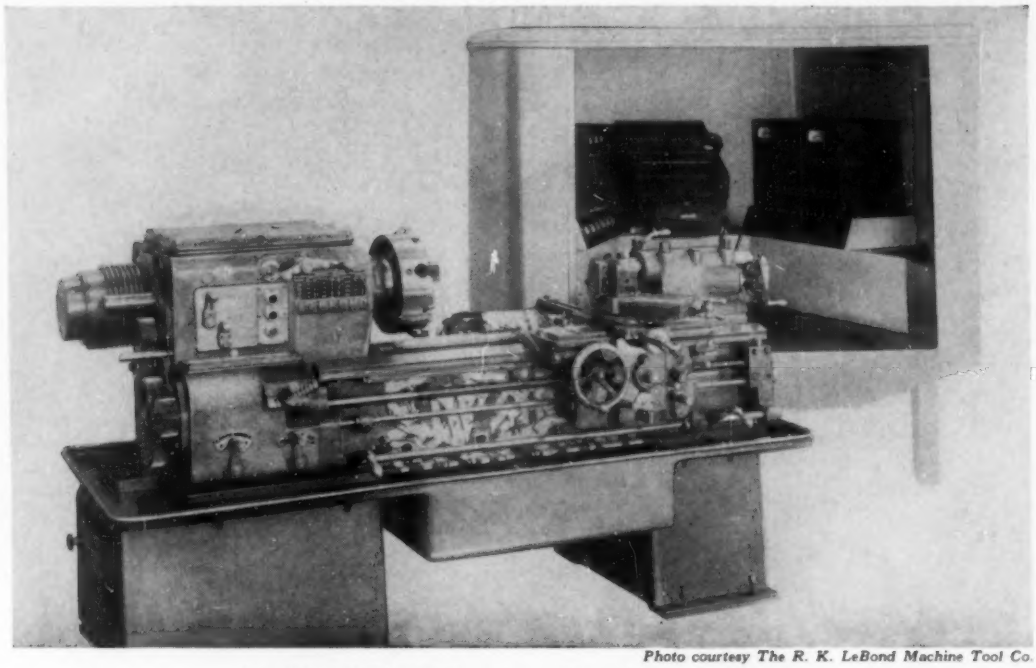


Photo courtesy The R. K. LeBond Machine Tool Co.

Fig. 10. A LeBlond lathe set up with strain gages and instrumentation so that 12 variables can be studied simultaneously.

Often, it will be found that the natural frequency of the gear train decreases as the spindle speeds increase. This is rather unfortunate because of the increased tendency of resonance at the lower frequencies, particularly when involving heavy masses.

Tests with strain gages, *Fig.* 10, indicate that an increase in natural frequency, an increase in rigidity and light machines reduce the range of resonance. Tool life can be substantially improved in rigid, light machines. These facts point toward the design of better machine tools capable of better production results. Such design may be achieved through proper use of welding, through consideration of stresses in iron castings or both. It is also necessary to distribute masses so the natural frequency of the machine is higher than the frequency induced by the cutting operation.

It is often advisable to separate cutting and vibration tests so that better control of vibration is possible. Vibration frequency changes during cutting tests as a result of hard spots in the workpiece and tool dulling. By imposing a vibration with a controlled frequency, it is possible to investigate its effects on various machine parts and to determine where and when resonance occurs. Resonance can destroy tools, especially carbides, cause chatter marks on the workpiece, and shorten life of the machine because of tooth impacts and backlash.

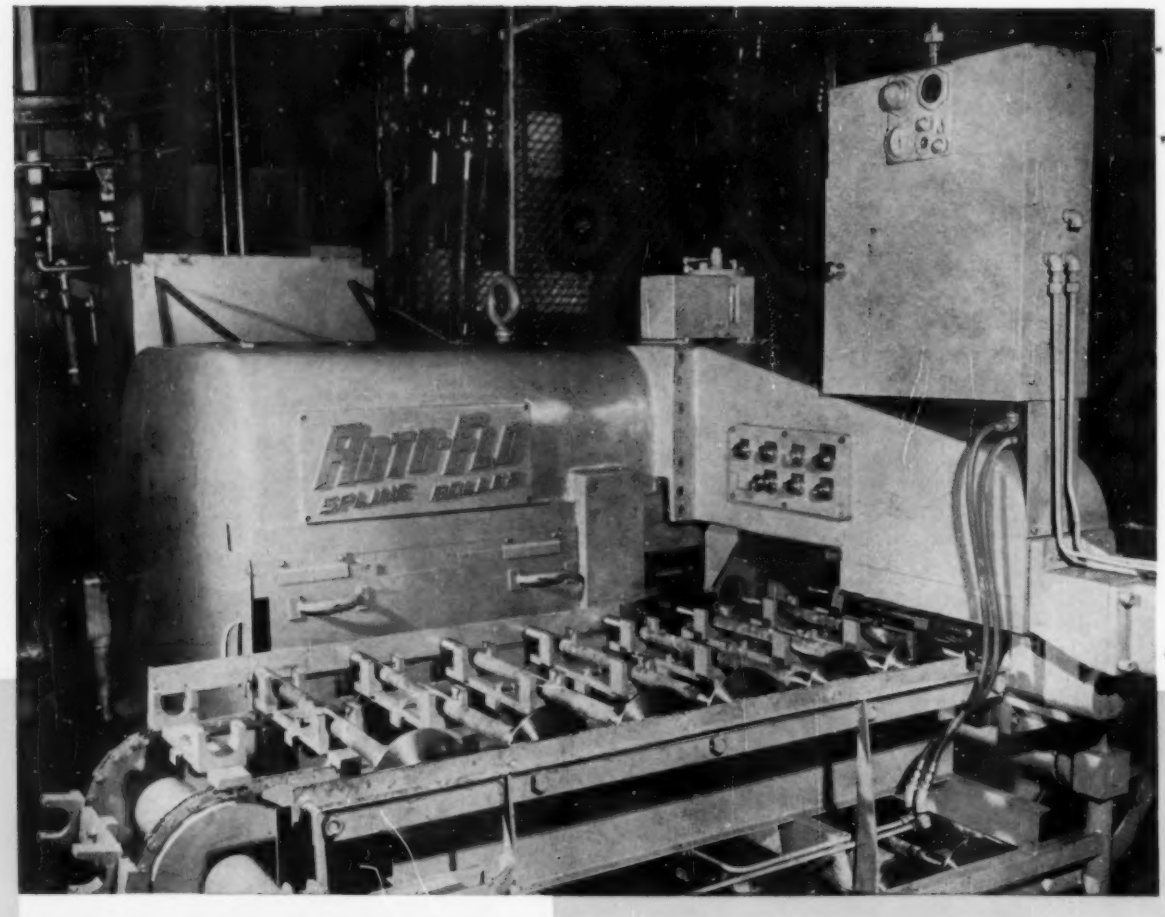
Since service life and salvage value have an important effect on the evaluation of machine tools and on the cost of production, machines should be built so values for these factors will be high. Machines can be evaluated for design and construction, and should be studied with a view toward reducing thermal expansion, distortion, deflection and vibration. Periodic tests of machine tools will result in accuracy, economy and sufficient information to indicate when replacement is necessary.

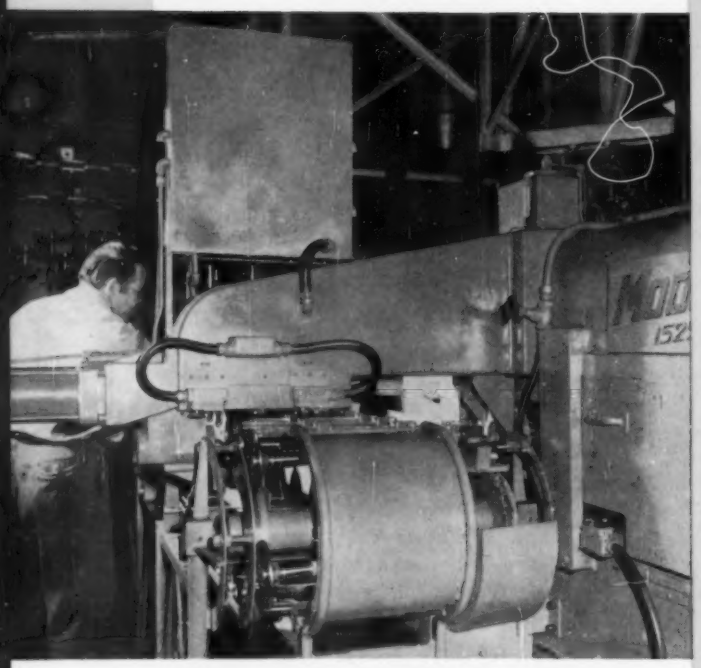
Electronic Computers Scratch Surface of Future Uses

Today's applications of electronic computers are only an indication of tomorrow's uses for business and management, as well as for engineering and research, according to opinion expressed at the annual Computer Applications Symposium at Illinois Institute of Technology.

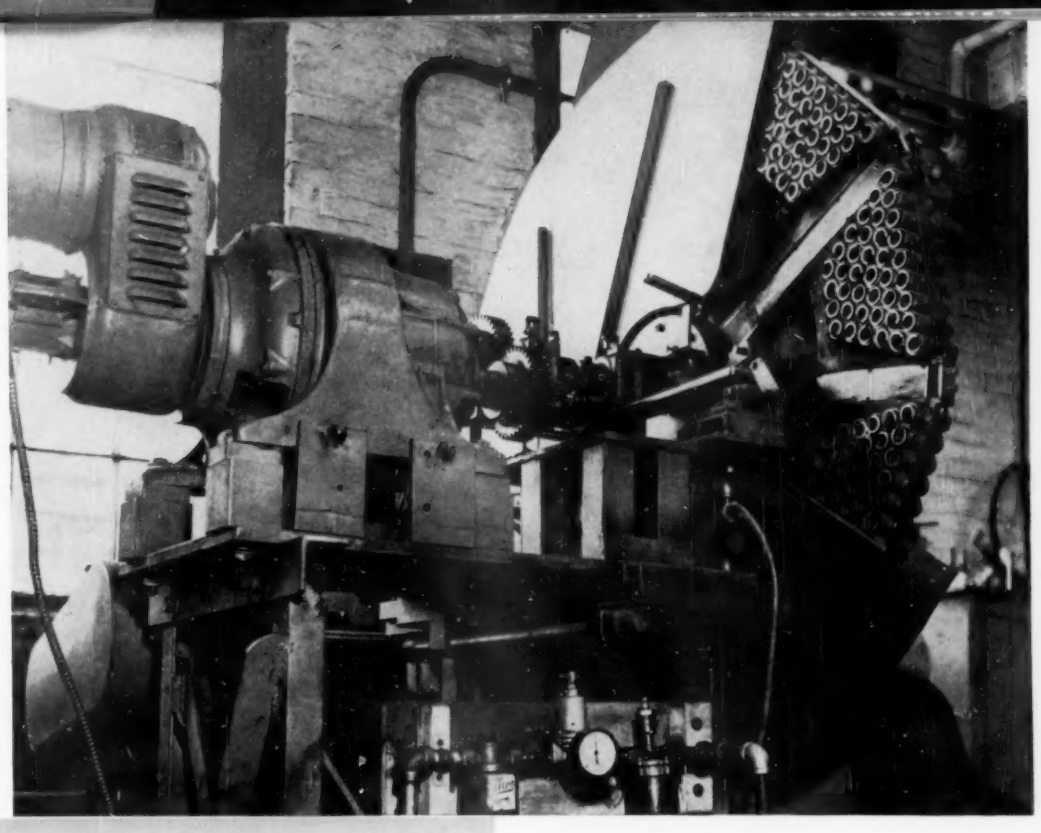
In connection with computation of engine performance, for example, J. T. Horner of Allison Div., General Motors Corp., voiced expectation of such improvements as development of symbolic internal computer codes, and faster devices with much larger and more compact high-speed internal memory.

At present, Allison is using three different types of computers; yet the company considers its operations neither as effective nor as economic as they will be made in the future.

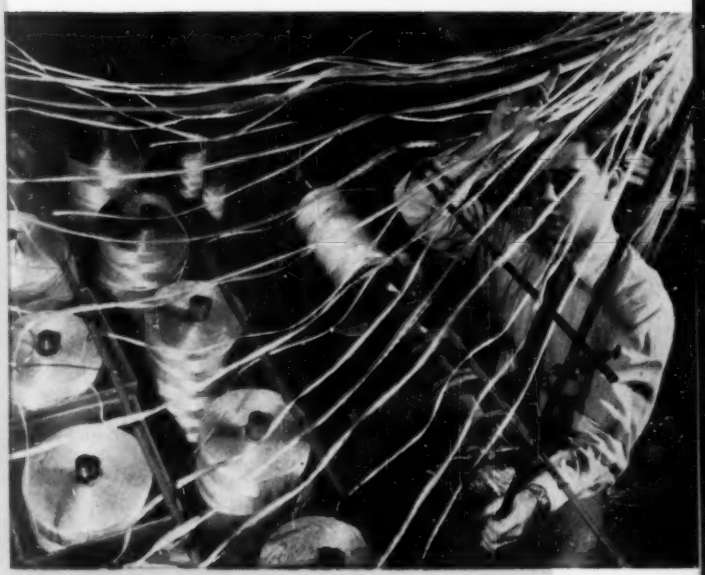




AUTOMATIC COLD FORMING produces splines on rear axle shafts at 300 per hour at Ford Motor Co. Mound Road plant. The process gives higher tooth strength and better surface finish than previous methods. Tool changing is minimized as 150,000 splines are rolled before tools must be removed for grinding. Design of the spline (left) was revised by production engineers to suit the new process. The forming cycle is automatic with the operator handling parts only for loading and unloading.

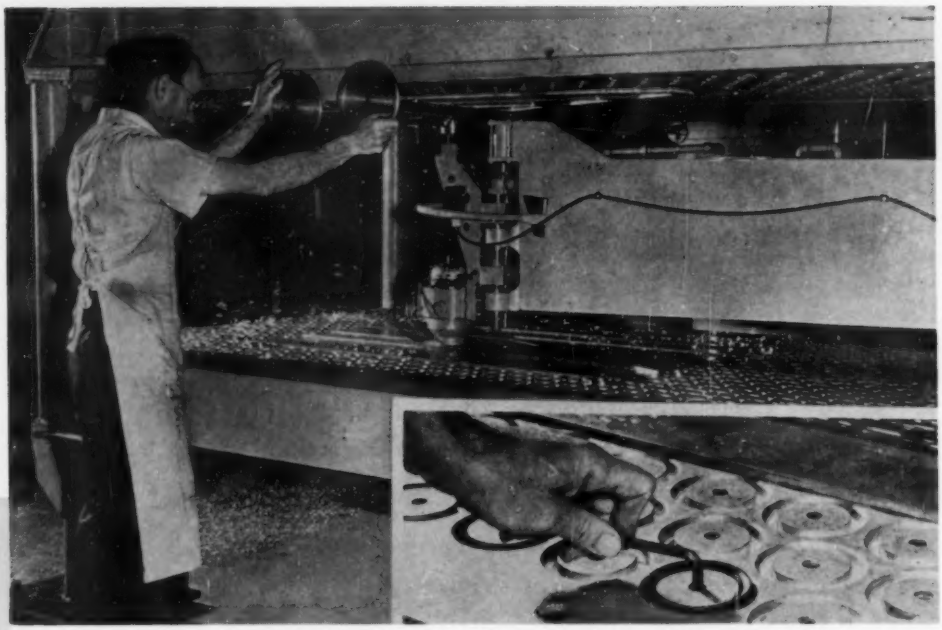


MERRY-GO-ROUND GRINDING operation on springs finishes both ends of part simultaneously, in Wallace Barnes Co. division of Associated Spring Corp., Bristol, Conn. With this multiple setup, 2000 pieces per hour can be completed. The job calls for tolerances of ½ to 1 deg squareness, 0.004 inch uniformity and removal of approximately 0.300 inch over-all. The machine is a modified Gardner vertical double-spindle grinder.



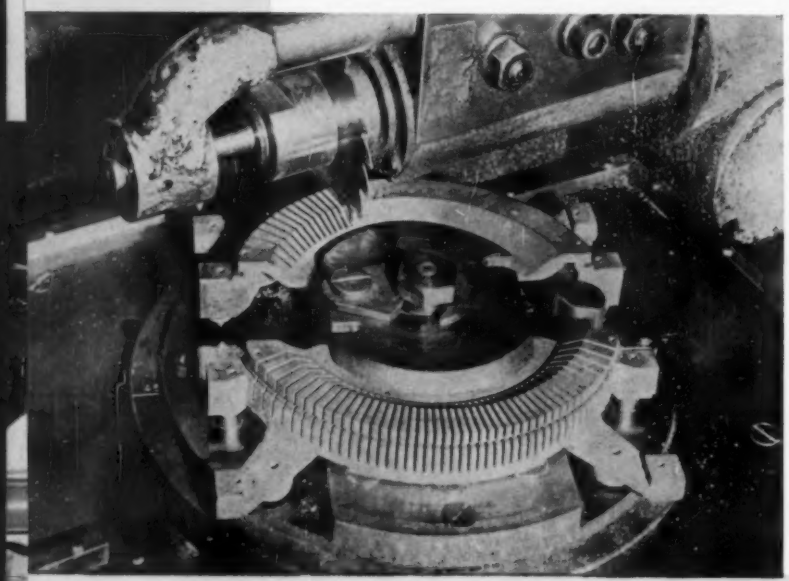
DEVELOPMENT OF PROCESSES for production of glass reinforced plastics resulted in a special arrangement for feeding strands of pure glass roving through locator screen prior to resin dip. After impregnation and baking, the strands become stronger than an equal weight of steel, according to G. E. Engineers. The study is being conducted at the company's locomotive and car equipment department in Schenectady.

TOOLS at work



SKIN MILLING operation is performed by means of special machine utilizing unusual vacuum chuck developed by Convair. Upper chuck holds pattern, lower chuck holds material. (Insert) Detail of suction cups shows removable rubber grommets. Screw in centerhole serves as shut-off valve. Various shaped skins can be held in chuck without sealing problems usually encountered.

—Photo courtesy Pioneer Tool Engineering, Inc., El Segundo, Calif.

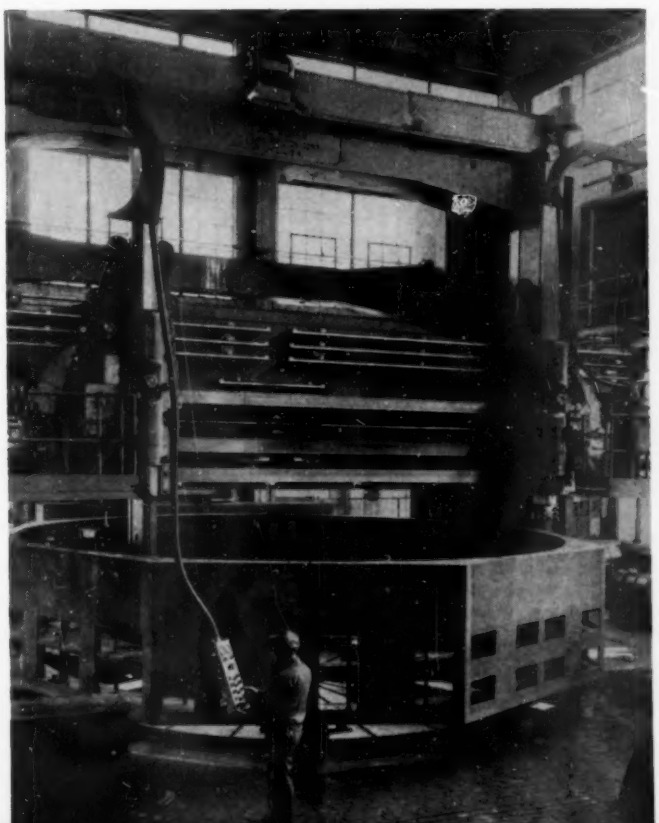


SPECIAL TOOLING increases production of type segments in the Syracuse plant of Smith-Corona Inc. Two parts are made in one setup by use of a jig which assures proper location of the cast workpieces. An indexing mechanism automatically positions the segments under the slotting saw for each cut. The 3½-inch carbide saws are specially designed of Carboloy grade 883, and operate at 700 rpm or cutter travel of 640 sfpm.

TOOLS at work

HOBBING A SPUR GEAR for locomotive drive is performed on 36-inch machine at Neville Island, Pa. plant of Pittsburgh Gear Co. Use of a forged blank extends hob life about 20 percent and likewise increases service life of the finished gear. The material is SAW-AISI 1035 Steel. The blanks are machined prior to hobbing.

—Photo courtesy Baldwin-Lima-Hamilton Corp.



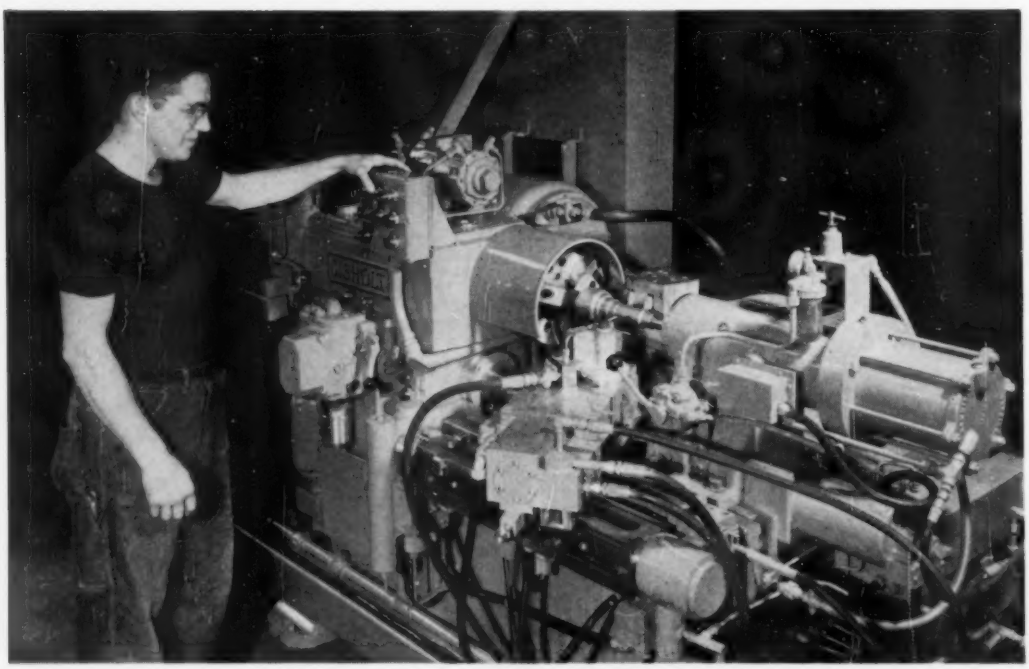
SETTING UP LARGE GENERATOR stator frame for finish machining in 30 ft. Niles vertical boring mill at Elliott Co., Jeannette, Pa. Electrically operated clamps on crossrail, crossrail saddles and rams minimize setup time and hold the settings rigidly accurate. Feed control is electronic. Since each ram has individual counterweights, one tool is used for rough and the other for finish cut. The newly installed machine was built by Baldwin-Lima-Hamilton Corp.

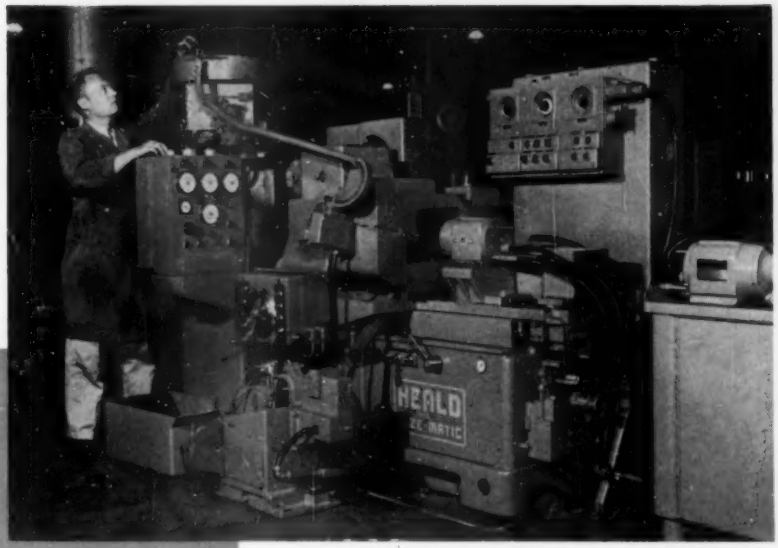
TOOLS at work

Tool grinding operation at Ford Mound Road plant on counterbore cutter. The tool is steel tantung alloy and the grinding wheel is a resin-bonded type operating at 3500 rpm. After mounting on the work head the tool is fed manually into the grinding wheel. Tolerances are held within 0.002 inch.

Turning operation employs automatic cycle in conjunction with hydraulic tracer. Flat template is under traced slide. Workpiece is turned in two passes in 1.8 minutes floor-to-floor time, utilizing tools on both front and rear slide.

Photo courtesy Gisholt Machine Co.





—Photo courtesy Heald Machine Co.

Fig. 1. Machine for grinding interrupted bore in automotive valve lifter utilizes feedback for automatic detection of drift. The control mechanism is tied in with chute gaging device in foreground and appears immediately above and to left under operator's hand.

Developments in Automatic Quality Control

By George H. Amber and Paul S. Amber

Consulting Engineers Detroit 35, Michigan

One of the most significant developments in metalworking is the harnessing of electronic "brains" to repetitive tasks. Numerical machine control with completely prepackaged tool and production engineering embodies this concept. True automatic quality control consists of parts inspection and self-correction within a machine. Its advent has been freely forecast as a necessity, if automatic production is to be consummated. Described in this article are the means for fulfillment, including a feasible installation of automatic quality control utilizing presently available components.

MOST TOOL ENGINEERS are aware that producing parts under statistical quality control procedures has many advantages. More plants adopt these methods every year as the principles involved become more generally known.

Quality control, however, is used less intensively than it could be. Its introduction and application is not always encouraged, even by those familiar with it. Some firms use it only to put out fires, that is, to cure acute production crises.

To be specific, although interest in the subject is increasing, quality control is actually used on only a small percentage of production machining jobs. One trouble is that quality control today consists primarily of manual operations. Another factor is the human element. Executives and machine operators seldom greet the introduction of quality control with unreserved enthusiasm. Quite a sales job is often involved. It is difficult at times to justify the necessary "constabulary" involved, the inspectors and checkers, etc. Budget directors have a way of tallying them up to the "nonproductive" or overhead side of the ledger. Summing up, quality control costs too much per piece part produced. Also, the addition of the many people involved is apt to create some friction. The object of this article is to show what can be done to make quality control operations more automatic *Fig.* 1, reducing the relatively high unit costs that result from manual operations.

Until the present, a tool engineer may have had a

—Photo courtesy Ford Motor Co.

Fig. 2. Quality control inspector measures a production sample, then plots the measurements on a quality control chart.

keen interest in applying quality control but has been faced with the problem of trying to match its hand methods against production that is becoming increasingly automatic. A tabulation of the basic operations for controlling production by statistical quality control shows that the techniques are manual by nature.

1. A sample is selected by an operator. The sample must be a true random selection or in accordance with a strict statistical program.
2. Individual measurements are made by an operator.
3. Measurements are plotted on a chart or graph by an operator.
4. Applicable quality control formulas are solved by an operator. Under certain circumstances, the range R may be used instead of standard deviation or σ.
5. The measurements and computations are interpreted by production personnel. A shift in the machine mean, X, would indicate a drift in the center line of machine performance. This would require readjustment of the machine. An increase in the standard deviation, σ, would indicate that an assignable cause factor may have entered the picture. This could require retooling, resetting the work or correcting a machine malfunction. The interpretation of "what to do" on the basis of data and charts is the key step in quality control.
6. The machine is readjusted by an operator to correct its drift.
7. Assignable causes of excessive dispersion, such as dull tools or a process defect, are corrected by an operator.

The essential operations all demand high-level skills of inspectors, *Fig.* 2, technicians, mathematicians, machinists and quality control professionals. There are no cheap hands in quality control.

No inference should be made from this that quality control personnel is inefficient. Quite the contrary. Industry is greatly indebted to the skilled practitioners in the field for many of today's high-production high-quality accomplishments.

Services of highly valued quality control statisticians, engineers, inspectors, and consultants must be used more effectively. It is indeed unfortunate that a considerable portion of their time is alloted to necessary repetitive plots, measurements, checks and computations, *Fig.* 3.

This is the paradox. The trend in manufacture is toward automation, to attain higher production at lower costs. But control of production by conventional statistical quality control methods demands more manpower than ever before. This is the soft spot in quality control—the use of skilled men for routine duties. To make quality control fully compatible with automation there must be more progress in eliminating the routine.

One of the basic observations made by investigators of automatic production is that routine and repetitive work is ideal for machines, while men on the other hand, do such work badly. The conclusion is that when repetitive work is encountered, a mechanism or machine to do the work should be considered. Many such opportunities can be found in quality control operations. This is illustrated by the previous list which describes seven basic steps of quality control when performed in the conventional manner. By contrast, the succeeding list describes the parallel steps of quality control when routine activities are performed by automatic electromechanical devices.

1. A sample is selected by an automatic programmer. Parts can be selected on a time basis by an automatic random programmer. Or the entire production can be used for the control by means of a continuous overlapping sample.
2. The individual dimensions are measured by automatically sequenced transducers. Transducers (pickoffs) convert the linear dimensions to an equivalent electrical signal (analogs) for the computer.
3. Measurements are automatically recorded on a chart or recorder strip. This is optional in automatic quality control as the parts in the sample bank form the "memory system" for storing recent measurements.
4. Quality control formulas are solved automatically by means of simple special-purpose analog computers. In many cases, computers can be replaced by means of integrating instruments that read out values such as machine mean, X, directly from the input signals.
5. Measurements and computations are interpreted by automatic discriminator and comparator units. These units must be presented by a skilled operator. A super-

visor can always read the machine mean, $\bar{X}$, and standard deviation σ, recording tapes to detect process performance.

6. The machine is adjusted to compensate for drift automatically, by means of power servo actuators.
7. Assignable causes of excessive dispersion must be corrected by an operator. Tool changes can be made automatically in some cases. This will correct some assignable causes. Actual repairs and machine system corrections, however, are maintenance operations, performed by machine maintenance personnel.

This type of mechanized quality control can greatly relieve the manpower problem. Personnel are free to work at higher levels of their profession, such as dealing with over-all production problems, group operations, linear programming and operations research. These people would then be working mostly behind the scenes, with the planners, machine control designers, electrical engineers and tool engineers.

Relieving quality control personnel of routine tasks will not reduce the total number of people in industry engaged in quality control work. Experience demonstrates that reducing the immediate tasks for a class of specialists, in fact, often increases the long range demand for such specialists. Time and again, mechanization of an industry, in the long run greatly increases the number of people employed in that activity. Common examples are the bottling industry, tobacco, food processing, clothing and printing.

The limited extent to which present day quality control methods can be adapted to automation has been recognized for some time. Spokesmen for industry have pointed out that automatic quality control would greatly aid production. While the advantages of fully automatic quality control are apparent, the practicality of attaining such a control system has not appeared to be realizable. This has been so because an automatic quality control system requires some type of computer and suitable ones were lacking. At last, small special-purpose analog computers, designed especially for automatic quality control, are available. Also, the technique for making suitable computers from off-the-shelf components, *Fig.* 4, is now practical. As a result, it is expected that there will be a number of automatic quality control installations in 1956, utilizing the techniques outlined here.

What has happened in recent months to make possible such computer control systems? The answer lies largely in military training aid programs. Numerous radar, operational flight, fire control and gunnery trainers were under wraps until recently. These devices all create training situations by simulating actual operational conditions of radar, aircraft, fire control directors, guns and tanks. The simulations are developed by solving mathematical equations that describe the situations involved.

Demand for simulators by the military encouraged development of unit assemblies from which small, special-purpose computers could be developed. These parts and units are now readily available. The logical development, combining machinery and small unitized analog computers, is yet to come, however. Few new machines incorporate computer elements as part of their control systems. Most of those that do, employ rather complex digital computer racks.

Specially designed machine-computer combinations will probably begin to appear in numerous applications in the next few years. Of course, automatic quality control is only one use of built-in computer units for machine control; undoubtedly there will be others. It is anticipated, however, that the most universal applications for such "bite size" computers will be in the field of quality control for some time to come; as by this means, practically all processes can automatically be controlled on a statistical basis quite accurately.

—Photo courtesy Ford Motor Co.

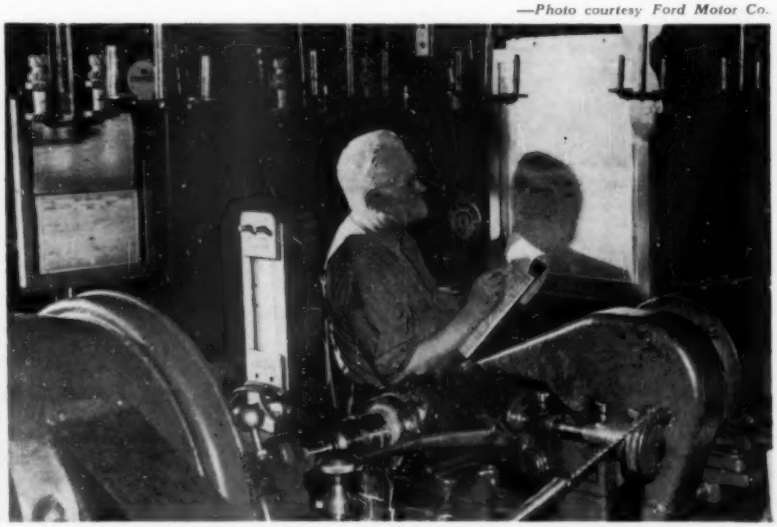
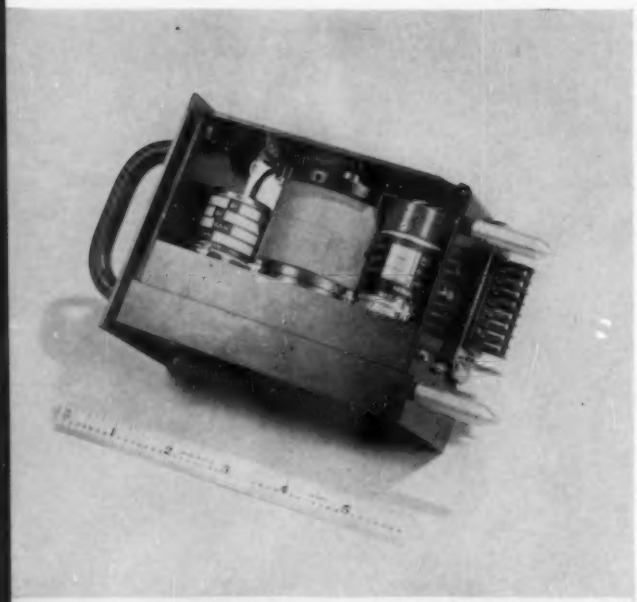


Fig. 3. Quality control inspector computes the average and range of a sample, then plots these values on a quality control chart. Interpreting the chart reveals if machine readjustments are necessary.



—Photo courtesy Transicoil Corp.

Fig. 4. Plug-in servo assemblies simplify design and assembly of small computers for automatic quality control.

Such setups are possible immediately, utilizing standard electrical components. So far, however, no one has wrapped up the computer into a standard package. This is rather surprising, considering that all quality control computers can be, for the most part, identical. Furthermore, every production machine is a prospective application. Accelerated by this tremendous potential field that awaits it, development of a "black box" containing a complete quality control computer may not be long in coming. It is expected, however, that the specific programming equipment, sequencers and instrumentation of transducer elements (pickoffs) to the production line will continue to be a custom proposition. While the availability of a packaged computer unit will greatly accelerate the spread of automatic quality control, for the present the computer as well as the instrumentation must be specially designed to fit each application. The basic function and control system of the entire machine tool must be designed concurrently, so that the machine and automatic quality control system form an integral production unit.

In general, manufactured products fall into two groups. The first are continuous products as sheet metal, wire, fluids, tubing, fabrics and paper. The second group consists of piece parts such as piston rings, cams, turbine blades, gears, engine blocks, or most items produced by means of machine tools.

Automatic quality control methods can be applied to both types of products. The design of suitable equipment for piece parts, however, is much more complex than for continuous products. This is due to the fact that some electromechanical means must be provided to time, transfer, sequence and select the various automatic measurements from the pickoffs. Instrumentation for automatic quality control of piece part production is well within the range of today's techniques, however, as will be shown.

Applications of automatic quality control in process industries, dealing with continuous processes are rather easily instrumented. In some cases the direct readout of the standard deviation is not considered absolutely necessary. It can readily be determined by an operator using a nomograph or slide rule, working on statistical data. This data is obtained directly from direct-reading integrator instruments.

A good example of parts produced to size by automatic quality control was described in the Aug. 1955 TOOL ENGINEER. Jones and Lamson Machine Co. developed an automatic lathe which uses statistical methods for controlling its production. The control system of this machine "recognizes the difference between normal dimensional variations and drift in machine output."

An outstanding characteristic of this machine is that it attains a form of practical automatic quality control without the need of computers. This indicates that advanced control techniques are not always dependent on electronic units, which some machine designers have been reluctant to accept. The use of servo computers, however, is often justified and even demanded by results and design features desired. For example, if it is deemed necessary to have explicit machine mean and standard deviation chart recordings of the functions, automatic segregation and inspection, and self correction by the machine, a true computer is a must, *Fig.* 5. But where something less will do the desired job, much simplification is possible.

Probably the best approach is for control designers and machine designers to work as a development team, so that the optimum arrangement of control system and machine can be attained. This design team should start working together during the early formulative stages of the machine design, before even the machine base has been produced. In this way, compatibility of machine and control system will be assured and neither will be compromised due to inflexibility of the other.

An electronically controlled hobbing machine is a combination of machine and control that has an automatic approach. The control system is a development of the Airborne Instruments Laboratories. Their automatic gear gage and hobbing machine control measures critical dimensions of each gear, sorts them according to production tolerance limits and automatically shifts the hob when necessary. In addition, it shuts off the power to the hobbing machine if it produces too many gears outside tolerance.

Automatic production can be operated without

automatic quality control. With few exceptions, automotive-type automation, which is classified as fairly simple from a control viewpoint, is not self-correcting and has yet to take advantage of automatic quality control. A necessity for higher orders of automaticity is that a machine not only inspects its own work but also corrects any tendency to produce parts outside of production limits. This requires that the machine continually monitor its output, usually by automatic measurements, in addition to performing its manufacturing function. Measurements of piece parts, whether manual or automatic, display the normal statistical distribution prevalent in most physical systems. So, except for gross adjustments, some means must be had to determine the central tendency of the machine, which is also called the machine mean. This machine mean is the familiar X, arithmetical average, and it usually requires some form of simple averaging computer. Such an arrangement is shown schematically in *Fig.* 6.

There are, however, mathematically sanctioned simplified methods that do not demand a computer. The J & L machine discussed previously, for example, uses the range of successive specimens, rather than the shift in the mean as an index of drift. This is a compromise, from a mathematical rather than operational viewpoint. Such an automatic quality control system does not present standard deviation and machine mean, X, in explicit form. Such short cut approaches are economically and engineering-wise justifiable, but the absence of direct mean and standard deviation outputs limit the use of quality control indicators, recorders, alarm systems and automatic classifiers. Also, the automatic computation of statistically accumulative assembly tolerance from the individual piece part tolerance cannot be performed. The computed mean, X, is a fundamental basis for quality control, both automatic and manual.

The machine mean is available in true automatic quality control for precise linear adjustment, not in discreet steps, of the machine tool cutter by means of a power servo actuator. Conversely, a self-correcting feedback controlled machine, which, referenced from the machine mean to a standard, would also give one of the two prime criteria for defining quality of a manufacturing process that is under control. The other criterion is the standard deviation.

Advantages of manual statistical quality control are retained when machines and manufacturing lines are instrumented for automatic control. Some additional features and advantages are worth noting. One is the machine sight, a visual bullseye to aid the operator of a manually controlled machine in setting it properly. The conventional control chart is a great aid to the alert machinist, telling him when to make

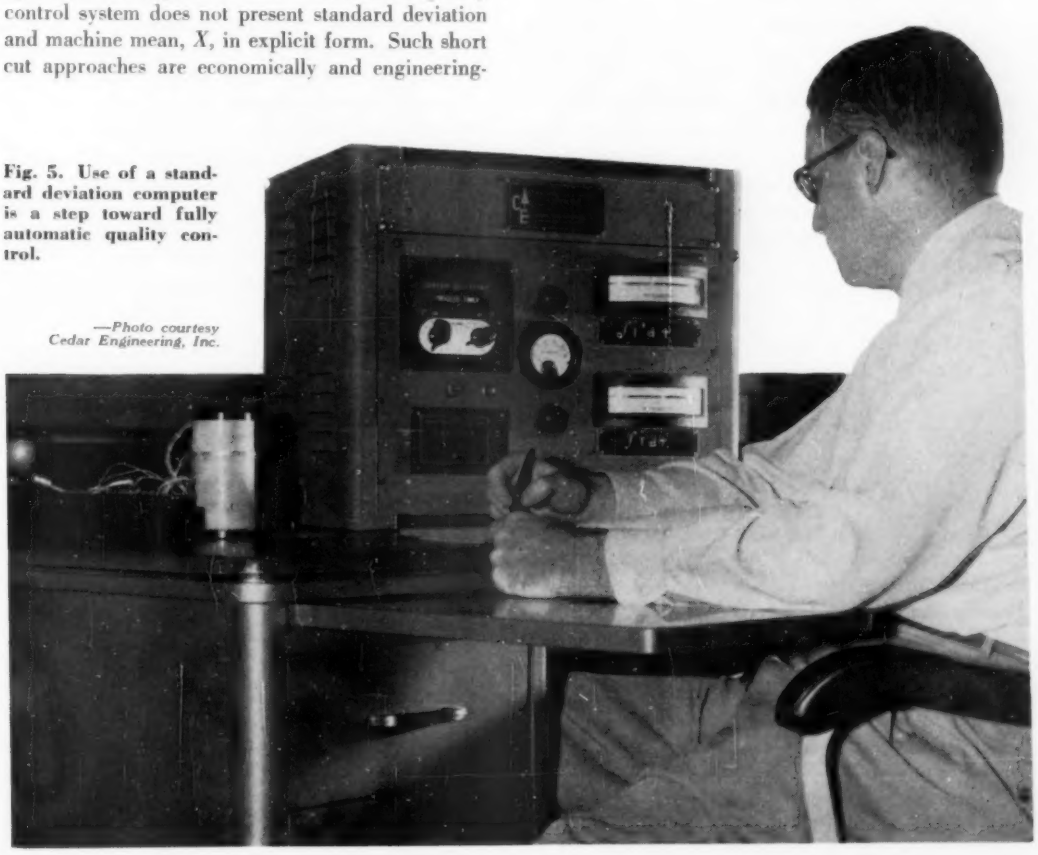


Fig. 5. Use of a standard deviation computer is a step toward fully automatic quality control.

—Photo courtesy Cedar Engineering, Inc.

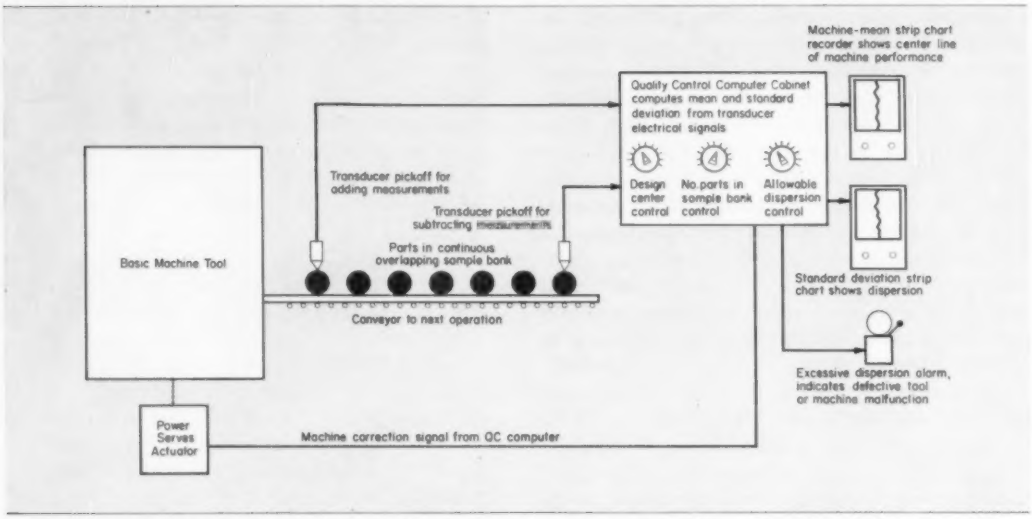

Machine-mean strip chart recorder shows center line of machine performance
Quality Control Computer Cabinet computes mean and standard deviation from transducer electrical signals
Design center control
No. parts in sample bank control
Allowable dispersion control
Transducer pickoff for adding measurements
Transducer pickoff for subtracting measurements
Parts in continuous overlapping sample bank
Basic Machine Tool
Conveyor to next operation
Standard deviation strip chart shows dispersion
Excessive dispersion alarm, indicates defective tool or machine malfunction
Power Servos Actuator
Machine correction signal from QC computer

Fig. 6. Simplified functional diagram of typical machine tool with built-in automatic quality control.

an adjustment and when to leave well enough alone. A visual machine mean indicator gives similar assistance and in addition responds more quickly to bad machine settings than would a hand plotted control chart.

Many manufacturing firms have found it necessary to maintain receiving inspection departments. Firms that produce piece parts for sale to other manufacturers, to the government or to assemblers, must at times provide certification attesting that inspection and quality control procedures were followed in accordance with a particular specification. With 100 percent automatic quality control, charts from automatic recording instruments could accompany each lot of parts that is shipped, to facilitate receiving inspection or customer acceptance.

Finally, built-in automatic quality control could prove to be a great boon to machine tool builders. It would positively prove the stability and reliability of a machine. Each machine has its natural tolerance, indicative of mechanical variations and spread of its performance. Naturally, the narrower the spread, the more precise the machine. Also, the drift of a machine, as shown by variations of an X indicator or recorder, would tell how stable a machine is.

From this discussion, it is apparent that the application of computer elements to machine tool control is far from simple. Tool engineers, alert to possibilities for improvements in production, can be expected to demand ever increasing use of the vast store of control technology and components now available. The trend to automatic control undoubtedly will accelerate as more experience is gained with it in the metalworking field.

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Develop Technique for Brazing Chromium Carbide

Practical production of brazed cemented chromium carbide with silver alloy filler metals has been advanced through a recently developed method. Brazing flux containing powdered boron, a strong reducing agent is used. The flux promotes good wetting and bonding between cemented chromium carbide and silver alloy filler metals.

Procedure begins with sandblasting of the chromium carbide and other steel surfaces to be joined. After cleaning these surfaces with a suitable solvent, flux is applied to the pieces; they are assembled in a jig or workholder, and brazing filler metal is preplaced in the joint. Heat of about 1450 F or 100 deg above the flow point of the filler metal is applied to the joint, taking care that any flame used is applied to the steel part of the assembly and that flux is not overheated. For best results, the chromium carbide is puddled when brazing temperature is reached, to avoid pockets of gases or flux.

This technique developed by Carboloy Dept. of General Electric Co. in cooperation with Handy & Harman, is expected to broaden use of cemented chromium carbide in applications in the 600 F range where alloys have been considered unusable.

Simplified Drawing SAVES TIME

By Edmund A. Cyrol

E. A. Cyrol & Co.
Chicago, Ill.

INDUSTRIAL REPORTS and analyses based on plant studies clearly indicate that the manufacturing methods in this country are undergoing significant change. More and more production engineering skill is being substituted for factory man-hours in the actual production phase of manufacturing. The rate of this change has been accelerating since World War II as manufacturing managers have been forced to find ways of holding down unit product costs despite the upward trend of factory hourly wages. The term "automation" embodies the idea, rather than a method, of substituting engineering knowledge for manual skills in the shop; proper utilization of manufacturing engineering skills can result in savings large enough to reduce net production costs.

The practicability of substituting knowledge for human muscle and skill is borne out in results that can be measured. In 1950, the gross national product totalled $286.3 billion with 60 million workers employed; the gross national product for 1954 amounted to $357.6 billion with an employment of 60.6 million. Certainly increased productivity through better engineered tooling and equipment is one factor in this over-all improvement.

The published statistics of manufacturing concerns operating profitably indicate that these companies are employing proportionately greater numbers of engineers as compared to their total employment. Bendix Aviation Corp. spends approximately 13 cents out of each sales dollar for engineering and research; the company employs a total of 7900 persons in the engineering classifications. The Minneapolis-Honeywell Regulator Co. employs one engineer for every eleven people on its payroll; it has grown from 2000 in 1940 to 12,000 employed in 1954.

What does this have to do with the man at the drafting board? Just this: His productivity is becoming more and more significant in the over-all picture. He can contribute importantly by doing his work with the least expenditure of time and energy. Drawings, particularly tool drawings, *Fig.* 1, should be produced in the simplest, understandable form in the shortest possible time.

Because even the simplest single-point cutting tool requires a drawing in a large manufacturing

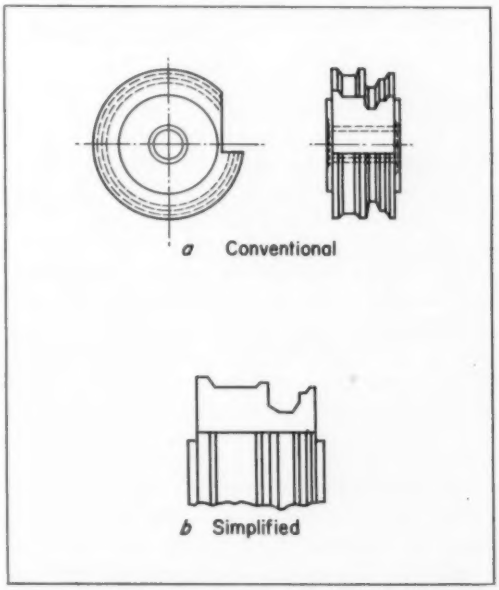


Fig. 1. Circular form tool conventionally drawn as in view *a*, is more simply described as in view *b* and the print is actually easier to read and understand.

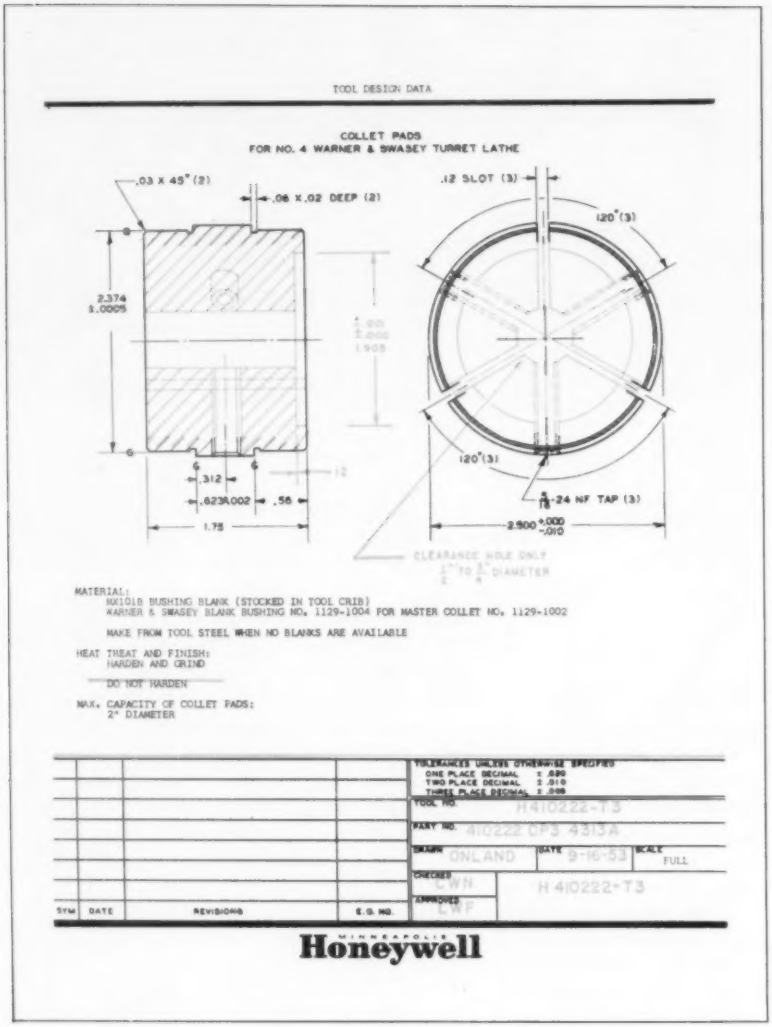


Fig. 2. Collet pad drawing is standardized by Minneapolis-Honeywell. Only information shown in color need be added for a particular part number.

organization does not mean that the tool's form must be completely detailed and that the drawing have a border and hand-lettered title block. Most drafting rooms have paper with a printed border, but how many have tool shanks, standard dimensions and notes preprinted? Even relatively complex die drawings can be partly printed and drafting time reduced by more than 50 percent. A printed tracing layout, such as *Fig.* 2, needs only a few additional lines and dimensions to become a complete tool drawing. Preprinted notes insure uniformity and decrease chance of error and omission. A crossed-out note indicates that the information is unnecessary for this particular tool but that this specific instruction to the toolmaker was not overlooked.

On the other hand, cutting tool drawings can be made more detailed when they are preprinted on tracing paper or made from Van Dykes or Sepias, because the detailed notes need be lettered in only once for many uses, *Fig.* 3. The drawing of the tool itself can be more pictorial, as in the shaded tap illustrated, since it will be reproduced many times. The prelettered notes also serve as a check list. Again the result is less drafting cost.

To be sure, simplified drafting is hardly a new idea. A general trend toward simpler drawings is clearly discernible. No longer is a complete screw thread drawn; modifications and symbols are used. A horse is no longer sketched in a drawing of a farm implement but many tool drawings still employ elaborate shadings of round and spherical parts and three views where one view with an explanatory note would do.

Ideas, which should serve as the starting point in stripping unnecessary artistry and frills from the drafting practices, are presented in a book based on a comprehensive study of practices throughout

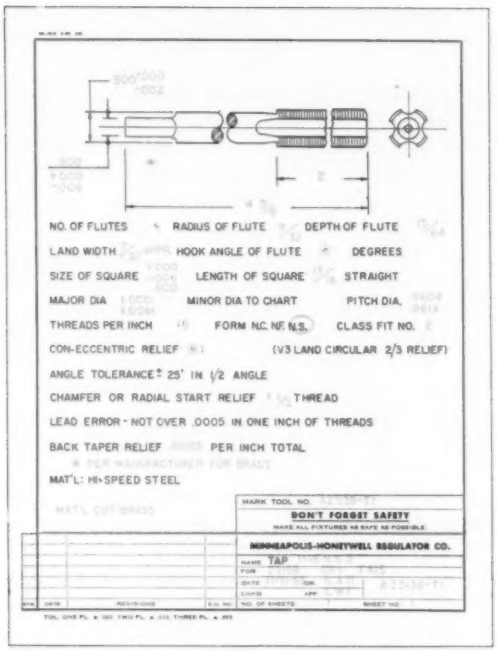


Fig. 3. Tap drawing as standardized by Minneapolis-Honeywell can be more pictorial as only dimensions and similar detailed data shown in color need be filled in. Much repetitive work is saved.

General Electric Co. This was published by John Wiley & Sons, Inc., under the title, *Simplified Drafting Practices*. The authors, Healy and Rau, suggest that a good motto for every industrial draftsman is "A superfluous line is a waste of time."

An open-minded approach to the use of freehand drawing, preprinted sections, more symbols, templates and mechanical aids, arrowless dimensioning and notes of explanation to eliminate delineation can save 15 to 50 percent of conventional drafting time. Such an approach is far from easy; the draftsman has his share of human resistance to change.

How can substantial time savings be made by drafting departments in a particular manufacturing or designing organization? There may be several approaches, but for proved results the following steps are recommended: First, a committee is established, comprised of the chief tool designer, the toolroom foreman or superintendent, the chief industrial engineer and the procedures or systems writer, if there is one in the organization.

Second, proved practices of other organizations are surveyed thoroughly, as presented in books like the one mentioned previously. The idea of the approach should be well established in the committee through discussion of the principles, stressing those that would especially apply to the particular situation. For instance, the committee selected to investigate simplified drafting for the plant can determine what is the best and cheapest way for simple subassemblies to be drawn, *Fig.* 4. The method selected must be acceptable and useful in the toolroom as well as in the drafting room. The tool designer, toolmaker and the tool inspector should be considered. Opportunities for time saving against the chances for errors must be weighed carefully.

Third, tool drawings in the company files should be reviewed critically, as if they were from some other organization's files. If some examples of unnecessary artistry, frills or fancy curlicues are found, a collection of them should be made.

Fourth, with the aid of the survey, a list should be prepared of ways that the unnecessary frills could be eliminated without destroying the usefulness of the drawings. This list can be made into a set of rules such as the following "Eleven Rules for Simplified Drafting," prepared by J. H. Bergen, Standards Administrator, Engineering Div., American Machine & Foundry Co., Greenwich, Conn.

1. Use description to eliminate delineation.
   Example: Instead of making a drawing of a sleeve or threaded stud, a satisfactory typewritten description of the article required may be made by a clerk.
2. Use description to eliminate projected views.
   Example: Call for hex, square, or round stock instead of drawing another view. Show the thickness of a part on a plan view instead of a projected view.
3. Omit elaborate, pictorial or repetitive detail.
   Example: Use broken lines to represent the OD, PD, and BD of a gear instead of drawing the gear teeth.
4. Use keyed legend to indicate nuts, bolts and other hardware. Show outline only where necessary to indicate position.
5. Use dotted lines only to add clarification.
6. Use cross-sectioning only to add clarification.
7. Use symbols to indicate various hole sizes.
8. Avoid the use of hand lettering.
9. Avoid use of arrowheads.
10. Use datum lines.
11. Make freehand drawings where possible. Use cross-sectioned board cover.

Fifth, the possibility of using techniques not normally associated with drafting practices should be investigated. For example, sometimes drawings are made after a fixture or piece of equipment is cobbled-up in the toolroom without benefit of drawings. Would a set of photographs serve the purpose as well? The potentials of photography may be profitably explored.

Sixth, with the investigation completed, a booklet should be prepared showing the time-saving practices that the organization will adopt. Seventh, several meetings should be held with tool designers, toolroom foremen and other interested persons to explain the simplified drafting practice to be adopted. Eighth, a loose-leaf notebook should be prepared in which new short cuts and simplified

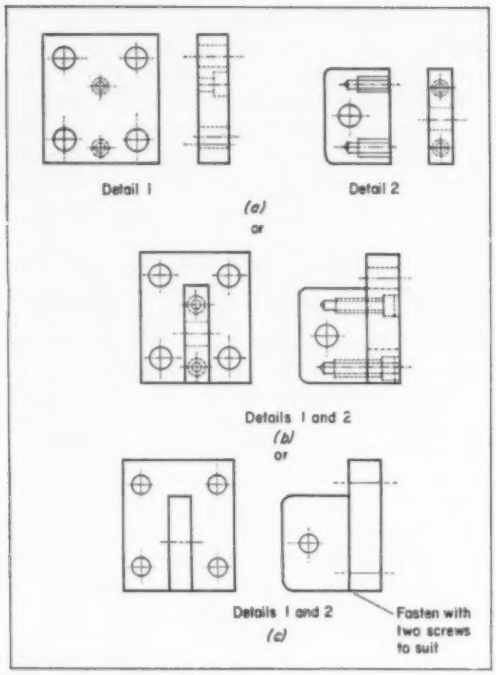


Fig. 4. (above) Simple subassemblies can be detailed as one piece with a saving of several drawings. View *a* shows detail of both parts on same drawing; view *b* shows details as conventional subassembly; view *c* shows simplified combined subassembly detail drawing.

drafting practices will be recorded and from which they will be periodically accumulated and distributed.

For instance, in its booklet, *Simplified Drafting*, Minneapolis-Honeywell indicates that "Drawings need not be to scale . . . . . since it's against the rules to scale a print anyway!" The booklet also presents samples of freehand drawings made by tool design department personnel, *Fig.* 5. The comment "These tools were made in our toolroom from these drawings" was included to overcome the expected negative reaction to freehand drawing.

There can be no doubt that drafting as an art has already contributed a great deal to the high standard of living this country is now enjoying. It is odd, though, that while it has been increasingly important in providing better equipment and tools to industry with which material wealth can be created, the art itself has remained relatively stagnant—still employing time-consuming conventions that have changed little in the last thirty years. Perhaps the time has arrived when sufficient new thinking can be engendered to allow drafting to makes its contribution to our material wealth at a lower cost in man-hours.

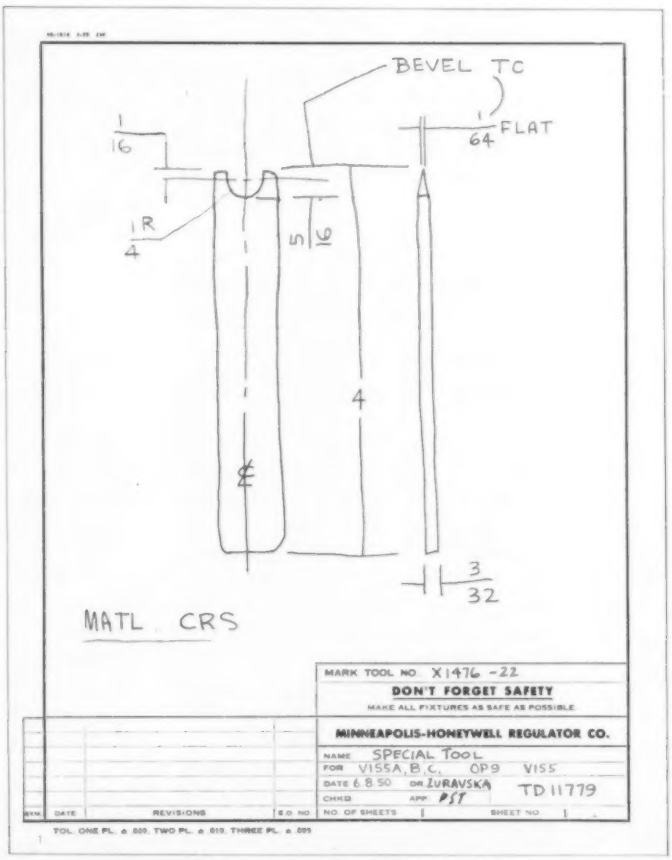


Fig. 5. (right) For simple, special tools, a freehand sketch on regular tracing paper is just as useful, but less expensive than a conventional drawing. Since drawings should never be scaled in the shop, minute accuracy and minute representation of detail, in many cases, serves no useful purpose.

plating with carbide

By Ralph H. Eshelman
Associate Editor

CARBIDE MATERIALS OFFER such unusual advantages for a wide variety of wear applications, that it was inevitable that some means of utilizing this coating or "plating" material for metal surfaces would be developed. Although solid carbide inserts and small tool or parts are highly successful for many applications, they have distinct limitations. Briefly, these involve high cost, size limitations and design requirements. Plating affords an extension of the field for carbides, *Fig.* 1, because it largely overcomes these objections.

A commercially practical process has been developed by Linde Air Products Co. and has been named Flame-Plating. Basically, the process deposits a coating by blasting tungsten carbide particles through a gun, *Fig.* 2, using explosive gases as a carrier. This method of bonding retains the properties of both the base material and the coating.

Carbide manufacturers are also interested in plating with carbides. For instance, it was recently reported that a method of applying thin layers of tungsten carbide to steel surfaces has been developed by the Carboloy department of GE. The technique is still in appraisal stages. It is different from other coating methods in that it provides a sintered carbide structure, according to company engineers. Such items as pickup pins, capstan rings, drill jig bushings and cylinder linings have been experimentally coated in thicknesses up to 0.030 inch. A major manufacturer of fishing equipment is reported to be setting up production of carbide plating of certain wear parts.

Linde engineers indicate that they have now accumulated sufficient experience to offer their process under a controlled leasing arrangement in which technical assistance will be available to the user. In their combustion process of carbide plating, the plating applied is composed of tungsten,

Fig. 1. Unusual tooling application of carbide plating is on the burnishing end of this broach, increasing its life more than six times.

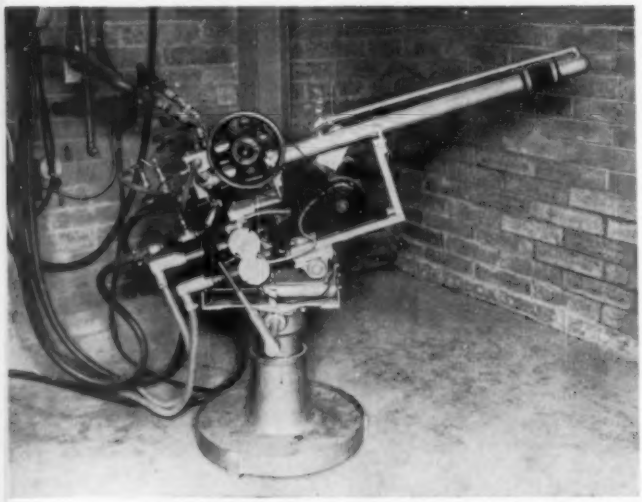


Fig. 2. Detonation gun used in Linde carbide flame-plating process.

carbon and 8 percent cobalt. The coatings differ from cemented carbide or sintered carbide structures, in that they consist essentially of a complex series of phases, derived from the W-C-Co system, *Fig.* 3, rather than a simple two-phase W-C-Co type structure.

By nature of the process, the coating consists of layers, or laminae, which are clearly revealed by etching. Each layer is composed of bodies flattened, spherical or angular, large or minute, related to each other in a more or less periodic manner. Even though there is a distinct boundary between the coating and the base metal, there is no visible oxide layer. The exact type of bond between coating and base metal has yet to be determined; however, according to indications it is more than mechanical, *Fig.* 4.

The density of the coating is substantially identical to that of solid cast material. Porosity is less than one percent. Adherence of the coating is excellent as demonstrated by the fact that it may be ground to the interface without peeling. The coating has a smooth matte surface which may be brought to a high polish by the precision grinding and polishing procedures used on carbide materials.

Description of Process

The detonation gun used in the process employs a barrel and a mechanism for loading precise quantities of tungsten carbide powder, acetylene and oxygen into the firing chamber, as illustrated in the schematic view, *Fig.* 5. The tungsten carbide powder remains suspended in the explosive gases until a spark ignites the mixture producing heat and pressure waves. The waves are concentrated by the shape of the barrel within a small area to produce tremendous heat and pressure.

As temperature reaches 6,000 F, detonation occurs, with the flame front moving at supersonic velocities. The tungsten carbide powder is suspended in the burned gases. Pressure inside the barrel reaches 10,000 psi in 0.003 second. After detonation, the shock wave dissipates into the air. Gases in the barrel burst out carrying the tungsten carbide powder. The particles of tungsten carbide become partially molten and are deposited on the workpiece at the velocity of approximately 9,000 feet per second, speed of the detonation wave.

Though the frequency of detonation may be varied, it is usually several per second for most carbide applications. The succession of blasts striking the surface of the part builds up the particles fusing them together until the desired thickness is obtained. Nitrogen is introduced into the gun from a conduit and poppet valve between each charge to purge the mixing chamber and protect the valves, preventing flash back on detonation. An additional purpose of the nitrogen is to drive out the hot combustion products and form a protective wall between them and the next combustible mixture charged.

Equipment Requirements: The size and length of the gun barrel is not critical provided that the length is at least several times the diameter of the bore. If the barrel is too short, the mixture will not detonate. Thus the size of the gun barrel will vary to suit the particular application.

Simple air cooling is ordinarily adequate for the barrel. Although temperature of the wave is high, upwards of 6,000 F, much of the heat is dissipated before the particles strike the workpiece. So, inherently, little heating of the workpiece results.

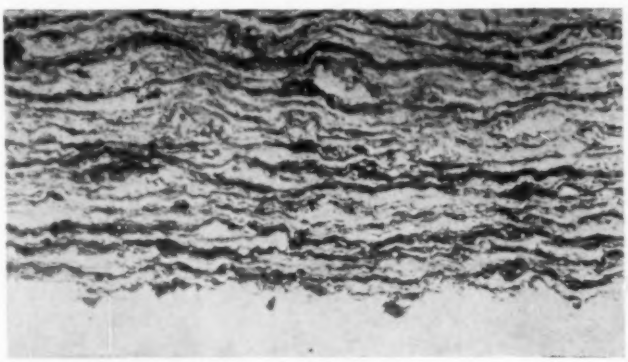


Fig. 3. Photomicrograph of carbide coating produced by Linde process.

Temperature of the workpiece seldom exceeds 400 F. Heat distortion thus is virtually no problem. Such heating as does occur can be readily overcome, or compensated by use of a cooling blast such as air or CO_2. Internal water cooling can be used when the workpiece is hollow. Precision and semiprecision parts can be plated without danger of changes in metallurgical properties or physical distortion.

A clean surface is required for the process, preferably roughened as by grit blasting or thinly coated with a soft metal such as copper, nickel or cobalt. The part to be plated is positioned about three inches from the open end of the gun. Under typical conditions, a layer of 0.020 inch thick tungsten carbide can be deposited at a rate of about one square inch per minute.

Results Obtained

Most metals can be plated including steels, cast iron, aluminum, copper, brass, bronze, molybdenum, titanium, nickel and magnesium. Chromium plate and sintered carbide, however, cannot be coated. Plated parts may be recoated if the original coating is first removed. Stripping is readily accomplished by means of an electrolytic bath. Coatings are commonly deposited in thicknesses of 0.002 to 0.010 inch, depending upon subsequent finishing. The larger amounts are deposited where part of the coating is to be subsequently removed in finishing. Surface of plated parts is about the consistency of fine emery paper, namely, 125 microinches rms, measured by a Brush analyzer. Plated products may be used in this condition or finished to various degrees of smoothness by brushing, grinding and lapping methods, depending on the application. Finishes of less than 1 microinch rms can be secured where desired.

Equipment Limitations: The size of parts that can be plated is limited primarily by handling equipment available. Round parts are usually held in conventional chucking arrangements, while long, flat surfaces are traversed by a fixture, as shown in *Fig.* 6. On flat areas to be finish ground, limits of plating at present are ¾ inch in width and 62 inches in length. Where indications of overlap between coating passes are not objectionable, limitations can be extended to 9 inches in width. Internal diameters, ⅜ inch or larger, can be coated where the depth of the hole does not exceed the diameter. Blind holes or cavities cannot be successfully coated. Grooves and similar depressions can often be coated but some difficulty may be experienced.

Design Considerations: The process is especially suitable for products or tools where wear is extremely critical, for instance, where mechanical functioning depends upon precision. Conversely, these types of coating are hardly appropriate for use on nonprecision parts where considerable wear is permissible, such as tractor treads or steam shovel teeth.

The shape of the part must be considered in making the decision to plate by this process. Since the coating is formed by particles striking the surface at high speeds, only areas which allow particles free and sufficient access can be plated evenly. Narrow holes, blind cavities and deep, V-shaped grooves are thereby eliminated. Plating of corners is sometimes unsatisfactory because of development of weak spots. Also, the process is unsuited for metal-cutting tools because the coating does not withstand this type of use. In addition, since the coating is thin, insufficient material is provided for resharpening.

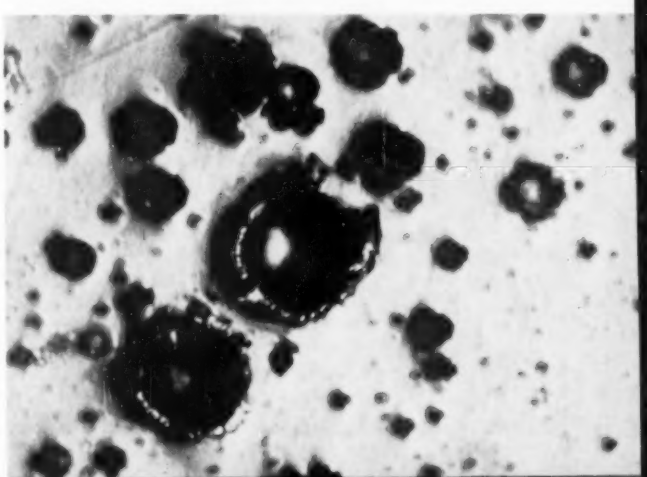


Fig. 4. One shot of detonation gun magnified 1000X indicates how tungsten carbide particles are imbedded in base metal.

While the coating is not designed to protect parts from corrosion, it has been found suitable for high temperature parts where fretting corrosion might be present. Reagents that attack cobalt will attack the tungsten carbide coating. This includes most acids and some alkalis. Mild alkalis, detergents, lubricating oils and atmosphere free from acid fumes in most cases have no detrimental effect.

Physical Properties: Tungsten carbide plating has excellent resistance to thermal shock. Strips loaded in tension to 15,000 psi, heated to 1350 F

in 45 seconds and cooled to 120 F in 30 seconds showed good test results. A plating of 0.010 inch failed after 6 cycles of heating and cooling, 0.005-inch plate started to fail after 200 cycles and 0.002-inch plate was unaffected after 500 cycles.

Hardness of the tungsten carbide coating averages about 1350 Vickers Pyramid Number. Particles of the coating are harder than indicated. The difference between actual particle hardness and measured hardness is due to the cobalt matrix. This results in an unusual combination of hardness and flexibility.

Modulus of elasticity of the coating is quite low, approximately 27 million psi compared to 64 to 92 million psi for sintered tungsten carbide. However, for maximum mechanical shock resistance, coating should not exceed 0.003 inch whether used in as-coated or ground finish condition. Stress causing permanent distortion of the base metal may impair coatings regardless of thickness.

The plating has a negligible amount of internal structural porosity, less than 0.5 percent. Coefficient of friction is comparatively low. Table 1 shows coefficients of kinetic friction measured with dry finished surfaces, ground and lapped to 2-4 microinches rms.

Applications

Many tooling applications have been found for carbide plating such as gages, forming dies, feed finger pads for automatic screw machines, gripping and feed dogs, wire forming mandrels, paper drills, plastic and rubber knives, *Fig. 7*.

Particularly for plug, ring, air and specialty gages, carbide plating has proved advantageous. They have been found superior in wear resistance to solid sintered carbide gages, yet are less fragile. They are less subject to edge-chipping and breakage, especially. With plating, gage blanks can be made of the same metal as the part being gaged. In this way, the coefficient of thermal expansion is identical, eliminating many temperature compensation problems.

In an automotive use for a cold-forming die, considerable economies were secured. These resulted from reduced machine down time, decreased inventory of replacement parts and lower tool maintenance costs. By comparison, in the same application, a tool steel die lasted four weeks, requiring polishing every other day after producing 14,000 parts. The plate die lasted seven weeks, producing a quarter of a million parts without maintenance. Total savings were estimated at $1200.

Another outstanding application for tungsten carbide plating is in aircraft turbine engine seals, *Fig. 7*. Large compressor seals, containing two stainless steel rings, rotate near shaft speed. The rings mate with and are retained by a sleeve. This seal operates at approximately 600 F with little or no lubrication. The smaller seal consists of a sliding, cylindrical bushing subject to vibration and having a relative 0.350-inch axial travel in the retainer. This seal operates practically without lubrication at nearly 800 F. It was found that the tungsten carbide plating satisfactorily solved the design problem. Previously, nitrided and casehardened seals failed because of fretting corrosion. The tungsten carbide plated seals gave more than twice specified service life and have become standard production items for this application.

Many industrial machine parts, such as rocker arms, sewing machine feed dogs, industrial knives and mandrels can be used with the as-coated sur-

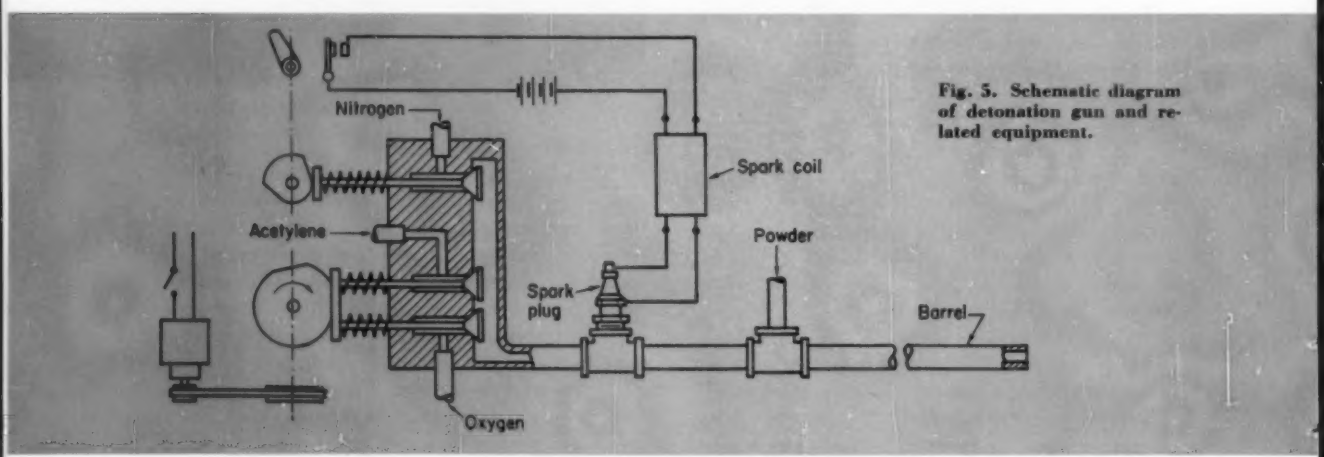


Fig. 5. Schematic diagram of detonation gun and related equipment.

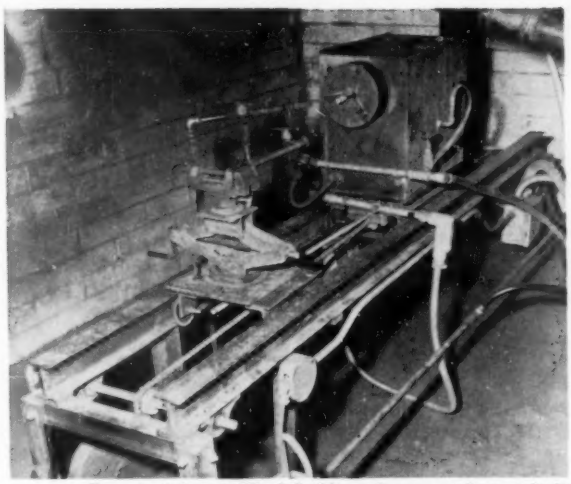


Fig. 6. (above) Work-holding fixture with part held in rotating chuck. Long workpieces are traversed past the gun barrel on the carriage.

Fig. 7. (right) Typical carbide plating applications including seals, gages, collet pads, gripper dogs and collets. A jet engine seal is shown at lower right.

face, increasing service life many times.

Other noteworthy applications have been for wire-forming mandrels where the coated parts are brush finished to 40-50 microinches rms to give a smooth surface. Many small parts for a variety of products ranging from film projectors to fishing reels are being coated at wear points.

While production to date has been on a job lot basis primarily, rather than a mass output, installations are possible for large-scale production. The greatest obstacle is the undesirable noise associated with detonation which requires special insulated installations, as much as 12 inches concrete block and brick.

Table 1—Coefficient of Friction for Various Mating Materials

Mating Surfaces	Coefficent of Friction*
Tungsten carbide surface on Tungstes carbide surface	0.18 to 0.2
Tungsten Carbide on Tool steel (Vicker's hardness 840)	0.16
Tungsten carbide surface on a 94-6 sintered tungsten carbide	0.20
Tool steel on tool steel	0.6
Chrome plate on chrome plate	0.4

*Values of kinetic friction have been measured using dry finished surfaces (ground and lapped to 2-4 microinches rms).

Production Requirements

As most carbide plated parts are of a precision nature, care must be taken, especially in finishing operations. For noncritical application, the as-coated surface has an excellent degree of roughness, providing gripping power for such parts as dogs and collets.

Nonprecision parts that require a fairly smooth surface can be given an intermediate finish of approximately 20 to 100 microinches, rms. These can be secured by lapping, flexible belt grinding or brush finishing. Where close tolerances are required, however, the coating must be ground and lapped.

Preparation and Finishing: Parts to be plated should be undersized to allow for finished thickness of the coating. Sharp corners should be avoided on any portion of the part receiving the coating. A minimum of 0.015-inch radius for chamfer is recommended when possible, not only where the finished part may be subjected to abuse but also to avoid chipping during grinding operations. These requirements are shown in *Fig. 8.*

Ordinarily 0.003 to 0.004 inch of coating is removed in finish grinding and lapping to close dimensional tolerances and low microinch finishes. For grinding operations, a 100 concentration resinoid bonded diamond wheel should be used. Silicon carbide wheels are not recommended. The usual wheel speed of 6,000 to 6,500 sfpm should be used.

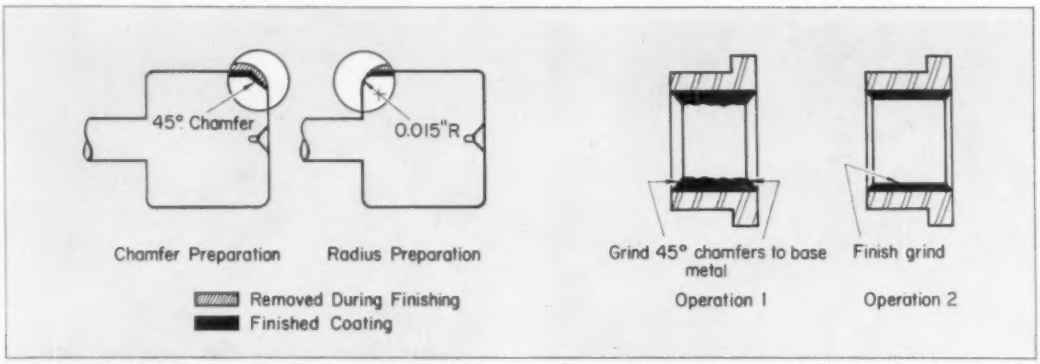


Fig. 8. Cylindrical parts should be undercut 0.004 to 0.006 inch on the diam with a chamfer or radius where coating is to be applied. Sleeve bearings should be bored 0.004 inch oversize before plating.

The wheel can be dressed with abrasive stick when it becomes dull as indicated by hard grinding or chattering. Flood type coolant must be used. Dry grinding will result in a damaged coating. The best coolant is water, with a small amount, 1 to 2 percent, of rust inhibitor such as a soluble grinding oil. Surface finishes obtained through use of recommended wheels are shown in TABLE 2. As low as 1 to 3 microinch, rms, finish is obtainable by lapping with fine diamond powder.

Table 2—Finishes Secured on Carbide Plated Surfaces

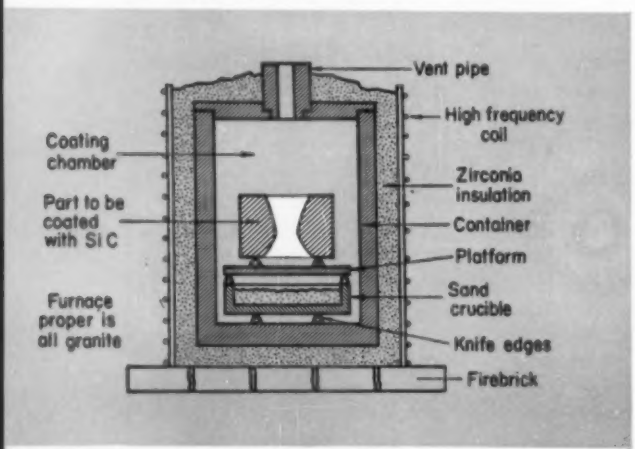
Diamond Grit Size	Wheel Grade	Max Stock Removal per Pass (inch)	Surface Finish (microinch rms)
100	L or N	0.0005	10-15
220	L or N	0.0003	6-10
320	L	0.0002	4- 8
400	L	0.0001	3- 6

Further Developments

In addition to the processes discussed, another promising development has recently been reported, giving a silicon carbide coating on a graphite base. This is designed for high temperature applications, such as combustion chambers of uncooled rocket motors and ramjet exhaust nozzles. The coating, developed by Norton Co., under the name Rokide C, is applied by reacting a graphite surface coating on the part with vapors from boiling silica sand, which forms silicon carbide, *Fig.* 10. The graphite surface itself is thereby transformed into a strongly adherent silicon carbide coating. This material stands next to diamond and boron carbide in hardness. The coating increases oxidation resistance by 300 to 400 percent.

Coating thickness is usually between 0.002 and 0.010 inch. Dimensional tolerances of plus or minus 0.010 inch can ordinarily be held. With present techniques and equipment shapes approximately 2 ft in diameter by 2 ft in length can be readily coated. Industrial field tests are being conducted in the process and it is expected that further development work will increase the scope and range of usefulness of the process.

Fig. 9. Silicon carbide coating furnace used in process developed by Norton Co.



Conclusion

While applications of carbide surfaces have been relatively limited, the possibilities inherent in these coatings are so attractive for many design problems and high-temperature applications that greatly expanded use can be expected in the future. Many difficult problems may now be met by combining the desirable properties of a base metal with the desired qualities of carbide for the surface.

identification of
mixed stainless steels

RAPID TESTS can be used to separate various types of stainless steels but chemical analysis is necessary if definite information on alloying elements present is desired. Test specimens, however, must be free of scale for these tests. Scale can be removed either by pickling or grinding. Spot-test solutions should be applied only to freshly ground areas. Tests are described and solution formulas are given on this page; the order of tests is shown in the chart on the next page.

Nitric Acid Test: A drop of solution, one part concentrated nitric acid and one part water, is placed on a freshly ground area. Attack is indicated by a boiling action or gas evolution.

Magnet Test: Austenitic (18-8) stainless steels are nonmagnetic when annealed but become slightly magnetic when cold worked. This is easily distinguished from strong magnetism of the straight chrome types.

Spark Test: Since nitric acid may attack some annealed types, this test separates 420 and 440 from nonstainless metals. These types are identified by the short, chrome spark.

Hardness Test: Specimens are heated to 1850°F and oil quenched. Carbon percentage ranges will be denoted by different hardnesses. Nonhardening types will show low hardness.

Muriatic Acid Test: Specimens are placed in a solution, one part muriatic acid and one part water, at a temperature of 180-190°F. Fresh solutions should be used for each test.

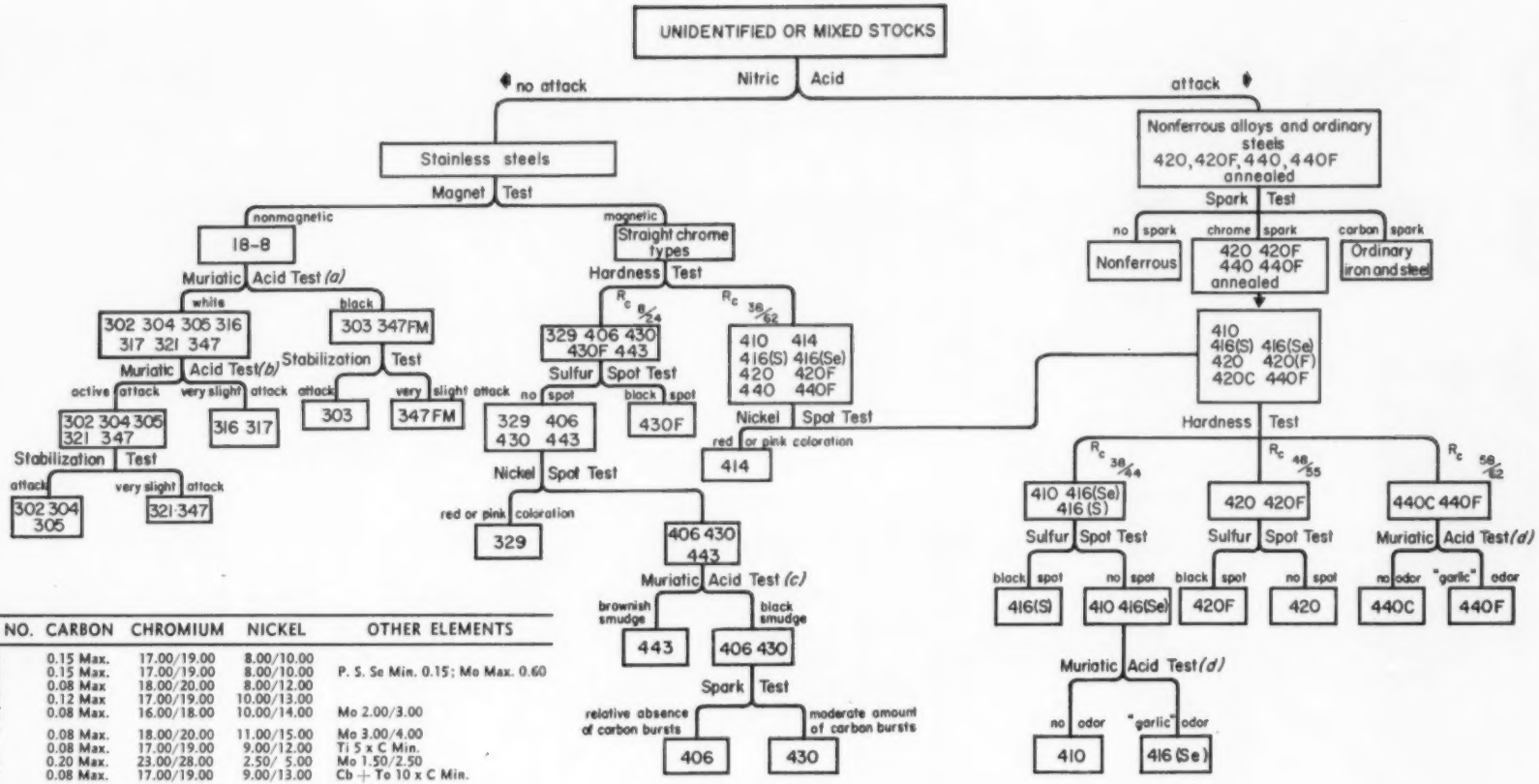
(a) After 5-minute immersion, 303 will be coated with a heavy, black smudge.
(b) Within 2 minutes after immersion, 316 can be identified by very slight acid attack as compared with active attack and evolution of gas on 302, 304, 321 and 347.
(c) Specimens immersed for at least 15 minutes. Brown smudge identifies 443.
(d) Specimens immersed for 5 minutes and removed. A pungent odor indicates 416(Se) and 440°F. Hydrogen selenide odor not present with 410 or 440.

Sulfur Spot Test: Three drops of solution, one part sulfuric acid and three parts water, are placed on specimens for 1 minute. One drop of 5 percent lead acetate in water is added to acid spot. After 15 sec, specimens are washed with water. A black sulfide deposit indicates 416(S), 420°F or 430°F.

Nickel Spot Test: Three solutions are required: (1) 125 cc water, 100 cc concentrated nitric acid and 25 cc of 85 percent phosphoric acid; (2) one part water and one part muriatic acid; and (3) 1 gram of dimethylglyoxime dissolved in 60 cc of glacial acetic acid. To this solution is added another prepared by dissolving 10 grams of ammonium acetate in 30 cc of ammonium hydroxide. Test procedure is followed by placing 1 drop of (1) on a specimen and adding 1 drop of (2) after 30 sec. After reacting for another 30 sec, mixture is absorbed by white blotting or filter paper. One drop of (3) placed on the moist spot indicates nickel by causing pink or red color.

Stabilization Test: Specimens are heated to 1250°F for 2 hours then air cooled to room temperature. They are then placed in a cold solution of 3 parts nitric acid, one part hydrofluoric acid and 6 parts water for 1 hour. After water wash, 321 and 347 show very slight attack and 302 and 304 have rough granular surfaces.

Data courtesy *The Carpenter Steel Co., Reading, Pa.*



TYPE NO.	CARBON	CHROMIUM	NICKEL	OTHER ELEMENTS
302	0.15 Max.	17.00/19.00	8.00/10.00	
303	0.15 Max.	17.00/19.00	8.00/10.00	P. S. Se Min. 0.15; Mo Max. 0.60
304	0.08 Max	18.00/20.00	8.00/12.00	
305	0.12 Max	17.00/19.00	10.00/13.00	
316	0.08 Max.	16.00/18.00	10.00/14.00	Mo 2.00/3.00
317	0.08 Max.	18.00/20.00	11.00/15.00	Mo 3.00/4.00
321	0.08 Max.	17.00/19.00	9.00/12.00	Ti 5 x C Min.
329	0.20 Max.	23.00/28.00	2.50/ 5.00	Mo 1.50/2.50
347	0.08 Max.	17.00/19.00	9.00/13.00	Cb + Ta 10 x C Min.
406	0.15 Max.	12.00/14.00		Al 3.50/4.50
410	0.15 Max.	11.50/13.50		
414	0.15 Max.	11.50/13.50	1.25/ 2.50	
416	0.15 Max.	12.00/14.00		P. S. Se Min. 0.15; Mo Max. 0.60
420	Over 0.15	12.00/14.00		
420F	Over 0.15	12.00/14.00		S. Se 0.07 Min.; Mo Max. 0.60
430	0.12 Max.	14.00/18.00		
430F	0.12 Max.	14.00/18.00		P. S. Se 0.15 Min.; Mo Max. 0.60
440A	0.60/0.75	16.00/18.00		Mo 0.75 Max.
440B	0.75/0.95	16.00/18.00		Mo 0.75 Max.
440C	0.95/1.20	16.00/18.00		Mo 0.75 Max.
440F	0.95/1.20	16.00/18.00		S. Se 0.07 Min.; Mo Max. 0.75
443	0.20 Max.	18.00/23.00		Cu 0.90/1.25

Method of Identifying Stainless Steels

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JANUARY 1956

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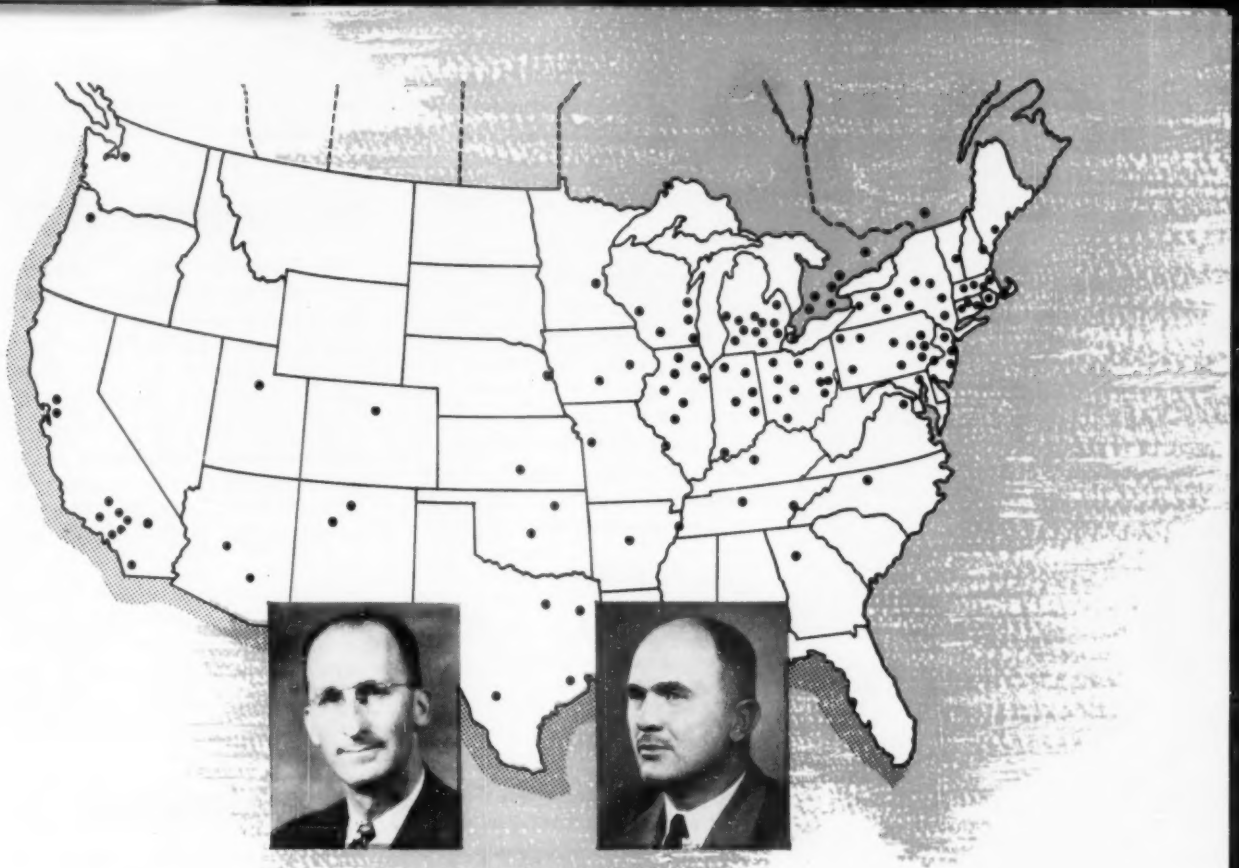


Candidates Named for Election to ASTE Board

Selection of candidates was made by members of the Annual Nominating Committee, who are pictured here, along with a map showing the geographic distribution of ASTE chapters. Counterclockwise are: Roger F. Waindle, chairman, Kenneth W. Riddle, William W. Schug, Francis J. Sehn and Wilfred B. Wells.

BY unanimous action of the undersigned Nominating Committee, we submit the following nominees for consideration by the House of Delegates, at its meeting to be held in Chicago during March, 1956, for election to the Board of Directors of the American Society of Tool Engineers:

Gustave B. Berlien
C-28 Golden Gate

Irving H. Buck
C-51 North Texas

Truman Coy
C-89 Greater Lancaster

*George A. Goodwin
C-18 Dayton

Philip R. Marsilius
C-6 Fairfield County

*William Moreland
C-12 Rockford

Joseph L. Petz
C-74 Mid-Hudson

Edward H. Ruder
C-57 Kansas City

Jack B. Savits
C-33 Boston

Leslie C. Seager
C-85 Salt Lake City

*Charles H. Smillie
C-1 Detroit

*William A. Thomas
C-55 Windsor, Ontario

George P. Torrence, Jr.
C-12 Rockford

As directed by the Constitution, we submit the nominations of the incumbent officers of the Society, who are:

*Howard C. McMillen
First Vice President
C-73 Evansville

*Harold E. Collins
Vice President *C-29 Houston*

*Raymond C. W. Peterson
Vice President *C-9 Toledo*

*Wayne Ewing
Vice President *C-27 Los Angeles*

*H. Dale Long
Treasurer *C-5 Chicago*

John X. Ryneska
Secretary *C-33 Boston*

From the above nominees, plus any further nominations that may be made as constitutionally provided, the House of Delegates will elect fourteen men to the Board of Directors. The fifteenth member of that Board is the retiring President, as provided by the Constitution.

*Incumbent Director

The Committee feels that the membership should be told about the earnest deliberations and the underlying reasoning that brought about its selections, so it is hoped that every member will carefully note the following important points.

Executive Ability

All nominees have demonstrated successful managerial ability in business and civic activities.

Service to the Society

A perusal of the biographical material appended to this report will indicate the ASTE background of the nominees. All have rendered distinctive and valuable service to our Society. All have agreed to serve, if elected.

Geography

Utmost consideration was given to the subject of service to the members. It is believed that the geographical distribution of the nominees is in direct relation to the distribution of our membership, which, quite logically, is also the same pattern as the industrial activity of the country. The latest survey "Value of Manufactured Products of the United States" was reference in this regard.

Why Only 13 Names?

The nominees were limited to 13 (plus the directed nominations) in order to give helpful guidance to the Delegates. It is hoped that this select list will serve to avoid some of the confusion that has existed occasionally in the past.

At the same time, the total of 19 names gives ample latitude for a true selection, by the Delegate, of the 14 men who in his judgment are best qualified to serve the Society in this important capacity.

Organized "Campaigning" Decried

The Committee urges the membership, and the Delegates, to refrain from high-pressure and "horse-trading" practices that sometimes have appeared prior to meetings of the House of Delegates. Dignified, intelligent presentation of a candidate's qualifications is proper and in order, and it is hoped that the Delegates will otherwise devote all of their attention to the genuine qualifications of the nominees.

The Committee notes with extreme regret that several men of outstanding qualifications have refused to permit the use of their names as candidates because of their distaste for engaging in a "popularity contest" or a political campaign.

Must Officers Be Directors?

The House of Delegates should exercise complete freedom in voting for Directors. The Society is a corporation that is being managed under the basic corporate system of balance of authority.

The Board of Directors is elected by the membership through the Delegates, and is responsible to the entire membership for the Society management. The Board elects the officer group, who may or may not be Directors, to manage the Society for the Board.

Be Sure To Elect The First Vice President

Constitutionally the President of the Society must be a member of the Board of Directors. This Committee recommends that your ranking Vice President be given the unanimous support of the House of Delegates.

Respectfully submitted,

Roger F. Waindle, Chairman
Kenneth W. Riddle
William W. Schug
Francis J. Sehn
Wilfred B. Wells

As provided in the ASTE Constitution, **Harry B. Osborn, Jr.**, now president of the Society and chairman of the Board of Directors, automatically becomes a member of the 1956-57 Board.

Howard C. McMillen, first vice president and an incumbent national director, is plant manager at Philco Corp., Bedford, Ind. He has served as second vice president, third vice president, national treasurer, and as chairman of the National Finance Committee. A senior member since 1939, he is a charter chairman of the Evansville chapter and also served Dayton chapter in a number of offices culminating in chairmanship. Mr. McMillen has wide executive experience in the refrigeration industry and is a member of the American Society of Refrigerating Engineers. He holds a bachelor of science degree in mechanical engineering and is a registered professional engineer.

Harold E. Collins, second vice president and an incumbent national director, is director of Hughes Tool Co., Ltd., Belfast, North Ireland, and manager of foreign operations for Hughes Tool Co. Former national treasurer, he has also served as third vice president and is now completing his ninth term on the Board of Directors. Charter member and past chairman of the Houston chapter, he became a senior member in 1939. Mr. Collins has served as consultant on machine tools to the Commerce Department in Washington, D. C. He is a member of the Army Ordnance Association; Institute of Production Engineers, England; Verein Deutscher Ingenieure, Germany; and is active in many other technical societies.

Raymond C. W. Peterson, third vice president and incumbent national director, is owner of Peterson Engineering Co., Toledo, Ohio. He has served one term as national treasurer, one term as national secretary, two terms as chairman of the National Standards Committee, and was secretary of the B-52 Committee of the American Standards Association. Active in chapter affairs since 1945, he is past chapter chairman and delegate. Mr. Peterson was instrumental in the establishment of the tool engineering course at the University of Toledo. His affiliations include the Pressed Metals Institute, of which he has been a director; the Ohio Society of Professional Engineers and ASME. A registered professional engineer, he holds a bachelor of science degree in mechanical engineering.

H. B. Osborn, Jr.

H. C. McMillen

H. E. Collins

R. C. W. Peterson

Wayne Ewing

H. D. Long

J. X. Ryneska

Wayne Ewing, fourth vice president and incumbent national director, is president of the Arrowsmith Tool & Die Co., Los Angeles, Calif. A former national secretary, he has served as vice chairman of the National Membership Committee and in most of the Los Angeles chapter offices, including the chairmanship. A member of the Society of Automotive Engineers and the Southern California Tool & Die Association, Mr. Ewing has devoted much of his time to several state and county committees for the education of apprentices in tool engineering.

H. Dale Long, national treasurer and incumbent national director, is president of Scully-Jones & Co., Chicago, Ill. He has served as a member of the Annual Nominating Committee and as chairman of the National Finance Committee. In 1952 he was cohost chairman of the Industrial Exposition and chairman of the House of Delegates that same year. Mr. Long has been chairman of the Chicago chapter and has held several other chapter offices. A graduate of the University of Illinois, he is very active in a number of civic organizations.

John X. Ryneska, national secretary of ASTE, is purchasing agent for the General Plant Utilities Section of the Medium Steam Turbine, Generator & Gear Dept., General Electric Co., Lynn, Mass. He has served as chairman of the National Constitution and By-Laws Committee, and as a member of the National Progress Committee, National Membership Review Committee, and the Annual Nominating Committee. A senior member since 1942, Mr. Ryneska is past chairman of Boston chapter and was general chairman for the 1946 semi-annual meeting. He is a member of the National Society of Professional Engineers and Massachusetts Society of Professional Engineers. He is also affiliated with the National Purchasing Agents Association and is active in community affairs.

Continued on next page

G. B. Berlien

L. H. Buck

Truman Coy

G. A. Goodwin

P. R. Marsilius

Gustave (Ben) Berlien is a partner in Industrial Steel Treating Co., Oakland, Calif. He was a member of the 1953 Annual Nominating Committee and is completing his second term with the National Editorial Committee, which he is currently serving as vice chairman. As a chapter officer, he has held nearly all positions, including the chairmanship. Author of the chapter on heat treatment in the *Tool Engineers Handbook*, Mr. Berlien has written many technical articles for metalworking publications and lectured before numerous ASTE and ASM chapters. He received his technical training at Northwestern University and Armour Institute of Technology. His affiliations include: ASM, Metal Treating Institute, American Society of Refrigeration Engineers and many civic organizations.

Irving H. Buck is president of the Tool Supply & Engineering Co., Dallas, Texas. A senior member since 1942 and a charter member of the North Texas chapter, he is completing his fourth term on the National Membership Committee. As Area Captain he has given considerable time to the chartering of several new chapters. Mr. Buck served in a number of chapter capacities, including three terms as chapter chairman. He is a member of the Dallas Engineers Club, Chamber of Commerce and is on the board of directors of Great Southwest Life Insurance Co.

Truman Coy, production engineering manager for the New Holland Machine Div. of Sperry Rand Corp., has had 22 years of industrial experience. A charter member, delegate and past chairman of Greater Lancaster chapter, he has been a senior member since 1942. He has served as chairman of Greater Lancaster's education and program committees, and was also active in committee work for Dayton and Philadelphia chapters. Mr. Coy was a session chairman and a panel member on the technical programs for the last two ASTE annual meetings. A member of the American Ordnance Association, he is also active in a number of civic organizations. He studied mechanical engineering at Ohio State University.

George A. Goodwin, chief process engineer, The Master Electric Co., Dayton, Ohio, is completing his sixth term as a national director. Former member and past chairman of the National Finance Committee, he was national treasurer for a period of three terms. He is a charter member of the Dayton chapter which he served as first vice chairman and chapter chairman. Mr. Goodwin has held various engineering positions since 1910 and is a registered professional engineer. He is a member of the Advisory Council on Tool Engineering of Sinclair College and is active in numerous professional organizations.

Philip R. Marsilius is vice president and sales manager of The Producto Machine Co., Bridgeport, Conn. He has been a member of the National Program Committee since 1954 and is now serving as committee chairman. Past chairman of the Fairfield County chapter, he has held nearly all chapter offices. Mr. Marsilius is national second vice president and a director of the National Tool & Die Manufacturers Association. He is also a past president of the Southern Connecticut Tool & Die Manufacturers Association. Active in civic affairs, he has served as an industry specialist with the National Production Authority at the Department of Commerce in Washington, D. C. He holds a bachelor of science degree from Norwich University and a master of science degree from MIT.

William Moreland, an incumbent national director, is vice president in charge of manufacturing at F. E. Myers & Bro. Co., Ashland, Ohio. A member of the National Standards Committee since 1945, he served as vice chairman for two terms and is now committee chairman. He has filled numerous chapter offices at Detroit and Rockford. A past chapter chairman, Mr. Moreland served most recently as Rockford's national delegate for the second time. He is a member of Technical Committee #7 for the American Standards Association and is the ASTE representative on that organization's Mechanical Standards Board. Active in several other engineering and professional groups, he is a member of the Ashland Chamber of Commerce.

Joseph L. Petz is secretary-treasurer of Petz-Emery Inc., and a partner in the J. L. Petz Co., both of Pleasant Valley, N. Y. He is completing his sixth term as a member of the National Editorial Committee and his third as committee chairman. Active in Mid-Hudson ASTE affairs, he has served as chapter chairman and in a number of other chapter capacities. In the field of tool engineering, Mr. Petz has taught tool design as an outside activity for 12 years. He is a member of the American Society for Metals.

Edward H. Ruder is vice president of Blackman & Nuetzel Machinery Co., Kansas City, Mo. A member of the Society since 1937, he has completed two terms as chairman of the National Public Relations Committee. Previously Mr. Ruder was chairman of the National Constitution and By-Laws Committee for a term, and one of its members for three years. As an active St. Louis chapter member, he held several offices, including the chairmanship, and recently transferred to Kansas City chapter. A registered professional engineer, he has had more than 20 years of industrial experience.

William Moreland

J. L. Petz

E. H. Ruder

J. B. Savits

L. C. Seager

Jack B. Savits is chief methods engineer at Pneumatic Scale Corp., Ltd., North Quincy, Mass., with whom he has been associated since 1917. Charter member of Boston chapter, he has served as chapter chairman and now heads the professional engineering committee. Mr. Savits is a registered professional engineer and member of both the Massachusetts and the National Society of Professional Engineers. A member of ASM and the American Ordnance Association, he has written numerous technical articles and addressed many regional and national meetings of ASTE and other organizations. He served on the War Production Board for a period during World War II, and is currently active in many technical and civic organizations.

Leslie C. Seager is chief production engineer at The Eimco Corp., Salt Lake City, Utah. He is serving his fourth term as a member of the National Professional Engineering Committee and is now committee chairman. Active in Salt Lake City ASTE activities, he helped in the formation of the chapter and served in a number of offices, including two terms as chairman. Mr. Seager aided in establishing the tool engineering curriculum at Utah State College and more recently helped establish a cooperative four-year tool engineering course at Westminster College, Salt Lake City. Past president of the Utah Engineering Council, he is affiliated with the Institution of Production Engineers in Great Britain and the American Ordnance Association.

Charles M. Smillie, president of the C. M. Smillie Co., Ferndale, Mich., is serving his second term as a member of the Board of Directors. He is past chairman of the National Professional Engineering Committee and also served two years on the National Membership Committee. A senior member of the Detroit chapter since 1940, he has held various chapter offices including the chairmanship. Mr. Smillie is chairman of the Michigan District of the National Screw Machine Products Association and state chairman of the Advisory Council of Scientists and Engineers of the Selective Service System. A registered professional engineer, he holds a degree in mechanical engineering.

C. M. Smillie

William A. Thomas, an incumbent national director, is superintendent of manufacturing engineering at the machine shop and stamping plant of the Ford Motor Co. of Canada, Ltd., Windsor, Ont. A former member of the Annual Nominating Committee, he has also held the position of national secretary and assistant secretary-treasurer, and was a member of the National Standards Committee for four years. On the chapter level, Mr. Thomas was elected to several offices, including the chairmanship at Windsor. He served three terms as chairman of the Canadian Standards Subcommittee and one term as chairman of the Canadian Data Sheet Subcommittee when those groups were active.

W. A. Thomas

George P. Torrence, Jr., is manager of the Small Tool Division of The Ingersoll Milling Machine Co., Rockford, Ill. He served three terms as a member of the National Editorial Committee and is currently chairman of the Technical Sessions Committee for the 1956 annual meeting in Chicago. A senior member since 1942, he has held all chapter offices, including the chairmanship, and has served on many chapter committees and is now a member of Rockford chapter's executive committee. Active in numerous civic organizations, Mr. Torrence holds a bachelor of science degree in mechanical engineering from Cornell University.

G. P. Torrence, Jr.

ASTE Prepares for

Anyone who has ever visited Chicago, host city for ASTE's 1956 Convention, will recognize famed Outer Drive and the Drake Hotel.

Breaking its own records is getting to be a habit with ASTE, particularly where conventions are concerned. This time it's the 1956 Industrial Exposition and Annual Meeting being held in Chicago, March 19-23, that is running up new achievements.

A complete sellout of space at an earlier date than ever before—expansion of exposition facilities—the largest group of authors ever to present technical papers before an ASTE Annual Meeting audience—and twelve outstanding plant tours—are just some of the factors pointing to the greatest ASTE convention week yet.

Exhibit Area Expanded

The "sold-out" sign was hung on the door of the exposition office two months ago. The entire original exhibit area of 151,000 square feet was spoken for, and the waiting list of industrial firms who wanted to exhibit in the Exposition was mounting every day.

It was the latter part of November when the Society decided it had to open another wing of the Chicago International Amphitheatre.

The new exhibit area is the North Hall, on the same level as the rest of the show and brings the total exhibit space to 164,000 square feet, an all-time ASTE record.

Nearly 50 additional companies will be accommodated in the additional section, bringing the total of exhibitors to approximately 500.

Technical Papers

In conjunction with the exposition which is in itself educational, the varied program of sessions featuring panel discussions, paper presentations, forums and films on the latest production topics will be presented.

More than 60 authors, the largest group of technical speakers ever to participate in an ASTE Annual meeting, will discuss timely subjects. All are recognized experts in their various fields.

With "Tooling for Tomorrow" as the theme for Exposition Week, each of the five days has been designated for special emphasis on different phases of production. They are: New Materials on Monday; Research on Tuesday; New Processes on

Largest Convention Yet

Wednesday; Management on Thursday; and Tool Engineering on Friday. All daytime technical sessions will be conveniently located in rooms adjacent to the exhibit area in the International Amphitheatre.

Plant Tours Announced

Paralleling technical program activities, twelve area plant tours have been arranged by the Chicago Host Committee, chairmaned by H. Verne Loeppert who is also chairman of ASTE's National Membership Committee. Plant tours are under the immediate supervision of Committee Member Fred Duff.

ASTE convention-goers will have opportunity to visit a wide variety of industrial firms for on-the-spot views of production and engineering methods.

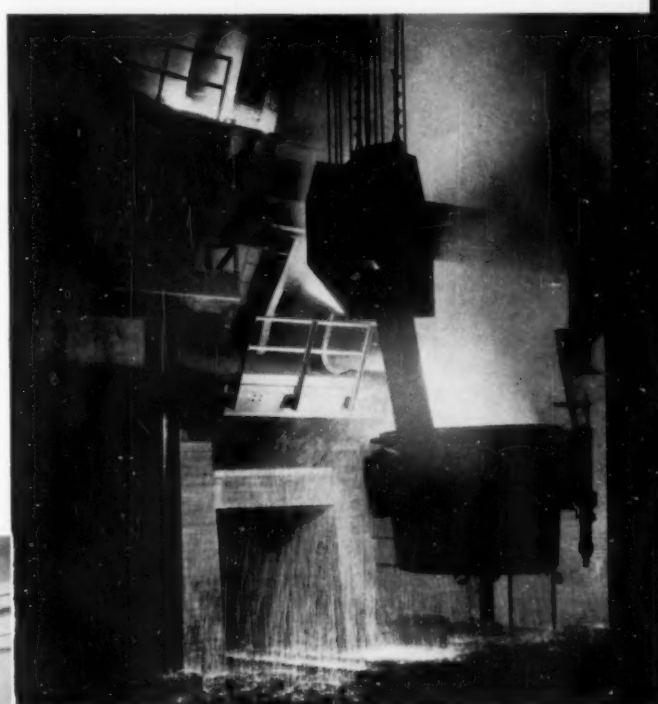
Scheduled tours include: Hotpoint Co., International Harvester Co., the Electro-Motive Division of General Motors Corp., Scully-Jones & Co., Motorola, Inc., Armour Research Foundation, the South Works of United States Steel Corp., the Merchandising, Testing and Development Laboratories of Sears and Roebuck Co., Skil Corp, Kropp Forge Co., the Aircraft Engineering Division of Ford Motor Co., and Verson Allsteel Press Corp.

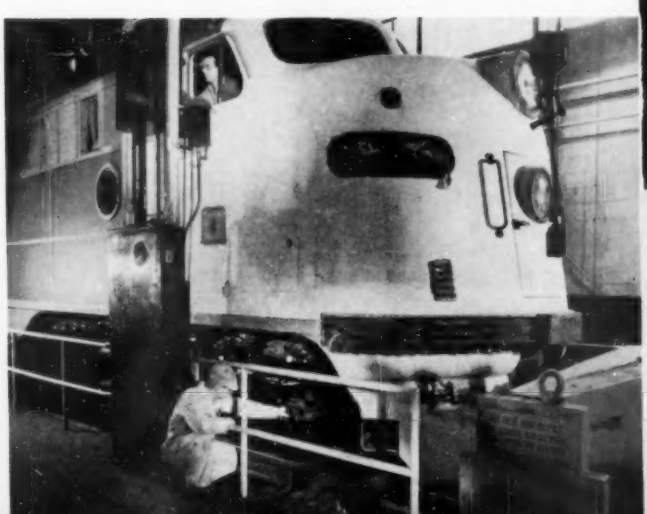
Those who visit Hotpoint will get a firsthand view of conveyor lines for producing ranges and refrigerators that, if combined, would reach 9.8 miles.

The International Harvester plant at Melrose, Ill., builds six different sizes of Diesel engines ranging from 52 to 200 horsepower. They also build large farm tractors, crawler tractors and power units for trucks, to mention a few.

At Electro-Motive Division of General Motors, LaGrange, Ill., visitors can see from beginning to end production of Diesel-electric locomotives.

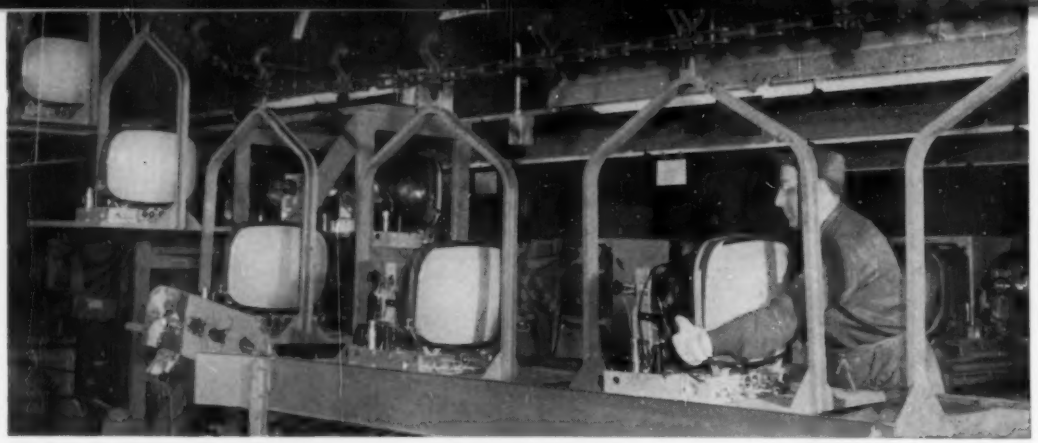
The Scully-Jones & Co. tour will prove interesting for those who want to know more about a plant that designs and manufactures precision holding tools such as drill and tap chucks, milling machine arbors and adapters, recessing tools, floating holders, and adjustable adapters for multiple spindles.





As shown in the above U. S. Steel photograph, visitors may see a 30-ton heat of electric furnace steel being tapped on their tour of the South Works of United States Steel Corp.

At left a locomotive is being tested on treadmill at Electro-Motive Division of General Motors Corp., La Grange, Ill., another plant tour arranged by the Chicago host committee.



Above, an overhead conveyor carries pre-tested television chassis to the final assembly line, which may be seen by those who tour Motorola, Inc.

The Conrad Hilton, designated as ASTE convention week headquarters next March, will be scene of the Annual Banquet and other traditional annual meeting activities.

The entire process for manufacturing a television set can be seen by those who take the tour of the Motorola plant.

Many phases of Armour Research Foundation's testing and developing for industry will be displayed for ASTE members who tour its facilities.

Producers of "custom-made" iron and steel for specifications of individual customers, the United States Steel Corp. will show ASTE visitors through operations from raw materials to finished products.

Testing Laboratories

The Merchandising, Testing and Development Laboratories of Sears and Roebuck Co. has the responsibility of assisting the buyer on any technical problems associated with merchandise. Technical specialists check products from every angle and will show ASTE visitors their methods.

Maker of Skil saws and other portable electric and pneumatic tools, Skil Corp.'s production machines are painted various colors following a color dynamics system which is a safety aid as well as a morale booster.

ASTE visitors who want to see a research metallurgical laboratory as well as flat die, drop forge, upset forging operations and heat-treating equipment won't want to miss the tour of Kropp Forge Co.

With the nation's first line of defense and retaliation jet aircraft, many will be interested in the tour of Ford Motor Co.'s Aircraft Engine Div., makers of the J-57 turbojet engine.

The women who accompany their husbands to Chicago haven't been forgotten either. A full and varied program, under the direction of Mrs. Richard C. Berliner of the Chicago Host Committee, is being planned. See page 136 of this issue for details.

Headquarters hotels for the exposition are the Conrad Hilton and the Palmer House, located in the Loop area, heart of Chicago. Special shuttle buses will carry visitors from all major hotels to the International Amphitheatre.

The Conrad Hilton will be the hub of national activities as site of the ASTE Board of Directors and the House of Delegates meetings. Two night technical sessions will be held there also.

The Hilton hotel will be the scene of another traditional ASTE event when the 24th Annual Banquet convenes on Thursday, March 22 in the Grand Ballroom.

January Membership Mailing

During the month of January every member of the Society will get an envelope from ASTE national headquarters containing complete information on the Industrial Exposition. In that envelope will be a card which, when filled out in advance, will make registration at the Amphitheatre easier and faster. About all that will remain to be done upon arrival at the exposition is payment of the $2 fee.

Also included in the mailing will be advance reservations for plant tours. Because of the extreme popularity of the tours, and because most of the companies have a limit to the number of people who can be accommodated, all persons must still confirm at the plant tour desks with the hour before buses leave so that somebody else can go in the place of the "no shows." Desks will be located at the International Amphitheatre and the Conrad Hilton.

The packet from headquarters will also contain hotel registration blanks, reservations for women's activities, the Annual Banquet reservation and a complete conference program.

It is not too early to start making plans for attending the exposition, little more than two months away. Travel reservations should be made early to avoid disappointment.

Significant developments in the production and tool engineering fields will attract manufacturing and engineering personnel in the United States, Canada and foreign countries. It will be the biggest week in history for ASTE.

Diamond Symposium to Play Starring Role in Exposition and Technical Meetings

For engineers feeling the impact of increased use of industrial diamonds, the forthcoming Diamond Symposium should get top billing as a "must" at ASTE's Exposition and Annual Meeting.

Concentrated attention will be given to possible applications of diamonds in industry and to actual experience with diamonds in production in the United States and other countries. With the existing literature on industrial diamonds and their use far from complete, the Symposium promises to furnish a great deal of basic and practical information on the subject.

Co-sponsoring the program with the Society is Armour Research Foundation of Illinois Institute of Technology, one of the oldest and best-known research foundations in the country. The extensive presentation will offer displays of gem, industrial and man-made diamonds; a complete operating shop producing diamond tools; and a series of 12 papers covering the scientific and the practical aspects of industrial diamonds.

Symposium events will be launched Monday evening, March 19, with a kickoff dinner at Illinois Institute of Technology. The Host Chapter Committee, headed by H. Verne Loeppert as chairman, is acting as a co-sponsor.

Featured speaker will be J. S. Gillespie, who is in charge of the man-made diamond project at Carboloy Department of General Electric Co. Mr. Gillespie will discuss the new man-made diamonds, some of their properties and some of their possible future uses.

Master of ceremonies for the dinner will be Dr. John T. Rettaliata, president of the Illinois Institute of Technology and also president of Armour Research Foundation.

On exhibit will be displays of diamonds—man-made, gem and industrial—totaling several million dollars. Diamonds for this special feature are being loaned by American jewelers, Industrial Distributors Ltd., and General Electric Co.

Since tickets to the dinner are limited to 400, advance registration is required. Tickets may be obtained by writing to: Diamond Dinner, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich. Requests for tickets, priced at $4 each, should be accompanied by checks or money orders.

Sessions on diamonds will continue through Tuesday and Wednesday, March 20 and 21. Papers, ranging from the scientific approach and theory to the manufacture of diamond tools and the practical applications of diamonds in production, will be presented by the outstanding experts in the industrial diamond field. Speakers are coming from South Africa, The Netherlands, Belgium, England, and the United States.

Another drawing card of the Diamond Symposium will be the elaborate exhibit at the ASTE Industrial Exposition.

Loaned to Armour Research Foundation by Industrial Distributors, Ltd., it will display more than a million dollars worth of industrial diamonds, as well as a complete operating shop in which several diamond cutters will actually be producing diamond tools on special machinery shipped from South Africa and Europe. Skilled personnel will be available at the exhibit to answer specific questions.

There's always something to do or see in Chicago, a favorite tourist and convention center for millions of visitors every year.

special convention program planned

for ASTE wives

With the woman's viewpoint as its theme, a particularly attractive program is in the making for ASTE wives who'll be in Chicago during Exposition Week, March 19-23. Luncheons, tours, a fashion show and tea are being arranged by a committee headed by Mrs. R. C. Berliner.

Launching the week's activities will be a reception on Monday, March 19, at the Conrad Hilton Hotel. Offering an ideal opportunity to get acquainted, the tea will be held in the ASTE ladies' lounge at the hotel.

Luncheon at the famed Kungsholm Scandinavian restaurant, high on nearly everyone's list of places to go in Chicago, is scheduled for Tuesday. Included will be a complete showing of the appealing Kungsholm puppets in miniature grand opera.

For those who'd like to learn how cosmetics are made, the Tuesday program also lists a tour of the manufacturing facilities at Helene Curtis Industries, Inc.

A fashion show and luncheon will be staged Wednesday by one of the country's leading department stores, Marshall Field & Co. The latest in imported styles will be featured, as well as the presentation of a number of door prizes and favors.

Thursday will be a pretty busy day, with the Annual ASTE Banquet (informal) in the evening, and a luncheon and two tours slated during the day. Rolling out the welcome mat for Society visitors will be Croydon China Co. and Italian Swiss Colony

Bottling Co. In between tours, luncheon will be served at Mickleberry's.

An unusual event will wind up the women's program on Friday when a trip to the Standard Oil Refinery, Hammond, Ind., is scheduled. "Sensible shoes" will be the order of the day for top enjoyment of seeing a refinery in action. Standard Oil will also be host at the luncheon.

Added to these special activities are many other attractions which have helped to rank Chicago among the nation's foremost convention and tourist centers. The wonderful shopping; top-flight restaurants, and plenty of them; numerous legitimate theaters offering a variety of entertainment; and many other points of interest could keep the visitor going for weeks.

Among the best-known landmarks in Chicago is the Merchandise Mart, largest building of its kind anywhere. Outsized only by the Pentagon, it is home to thousands of wholesalers and a magnet for merchants and buyers from every section of the map. Tours of the Mart are scheduled every half-hour on weekdays.

Chinatown is a picturesque community with gift shops, and restaurants serving Cantonese food. The exotic Chinese Temple in the On Leong Merchants Association building is open to the public every day.

One of the finest historical collections in America is housed at the Chicago Historical Museum in Lincoln Park. Closer to the Loop, world-famous paintings, prints and sculpture are on display at the Art Institute.

The Museum of Science and Industry on the lake front has preserved the most discussed technical exhibits of the World's Fairs of 1893 and 1933.

Not to be overlooked on the sight-seeing agenda is the Merchandise Mart, largest building of its kind.

The Board of Trade, dominating the financial district, is the city's tallest building and the largest grain exchange in the world. A special gallery is open on weekdays where spectators can watch the trading. Atop the 45th floor is a glass-enclosed tower from which the sight-seer can look into Indiana and Wisconsin. Observation towers are also located at the Wrigley Building and at Tribune Tower.

Millions of visitors have seen the Shedd Aquarium, most complete in the world, with more than 10,000 specimens. The wonders of the skies, reproduced and explained at Adler Planetarium, also attract record crowds of visitors.

Authentic New England decor provides a quaint atmosphere in the Drake Hotel's Cape Cod Room, one of the best spots in town for sea food.

Popular stop for Chicago visitors interested in fish of the nonedible variety is the Shedd Aquarium, noted for its 10,000 live specimens.

Staging the recent on-campus conference at San Jose State College was the responsibility of these committee members and featured speakers. The two-day meeting, held Nov. 4 and 5, was sponsored by the Santa Clara Valley and Golden Gate chapters of ASTE, the National Education Committee, and the engineering staff at the college.

Pictured in the front row, from left, are: Angelo Dell 'Era, Santa Clara education chairman; Marvin Bunting, staff administrator for national headquarters; Lowell Hand, speaker; August Hill, speaker and member of San Diego chapter; Prof. Frederick Preator, Salt Lake City member, and also a member of the National Education Committee; and Frank Menard, Santa Clara chairman.

Shown in the second row: Alan G. Dimond, Santa Clara secretary; William G. Burge, Santa Clara treasurer; William T. Wright, Santa Clara first vice chairman; Wayne Ewing, national vice president and member of the ASTE Board of Directors; Andrew Rylander, long-time ASTE'er and speaker at the conference; Hans O. Metz, first vice chairman at Golden Gate; Hugh McGee, Santa Clara Valley member; and Ted Lindquist, Golden Gate chapter chairman.

In the back row: Lew Sink, Santa Clara member; Clifford B. Marker, Golden Gate education chairman; John Groves, Santa Clara treasurer; E. K. Freidli, speaker; James Ellison, speaker; Dresden Smith and E. C. Holden, both of Santa Clara Valley chapter.

John Hussey Is Speaker At New Orleans Meeting

A talk on "How the Hydraulic Duplicating Lathes Is Used as a Production Tool" was featured at the October meeting of New Orleans chapter. Speaking to the group at Frank's Steak House was John Hussey of The American Tool Works Co. Illustrating his discussion was a series of slides showing different applications.

—Joseph Natal

Calumet Area Chapter Hosts Ladies' Night

Attracting an attendance of well over 100 members and guests, Calumet Area chapter staged its ladies' night meeting on Nov. 4 at the Cape Cod Restaurant. Prizes and a program of entertainment helped make the evening successful. A team of magicians and music by an organist were featured, along with the dinner activities.

—L. W. Montgomery

University of Michigan Visits Alcoa Foundry

A trip to Detroit was on the Oct. 13 agenda for student members of the University of Michigan chapter at Ann Arbor. Object of the trip was a tour of the Alcoa Foundry where the group observed plaster, green sand and permanent mold casting operations.

A few days later, members attended a meeting where Curt Tech, vice president of the Cross Machine Tool Co., gave an illustrated talk on "Trends in Automation." *—William A. Hornett*

New Haven Chapter Hears Talk by James Meehan

With an attendance of 85 New Haven members on hand, the Nov. 10 program speaker covered the topic "Meeting the Challenge of Diminishing Grinding Tolerances." Addressing the chapter was James Meehan, sales director of Brown & Sharpe.

Another feature of the meeting was the selection of John Alton, John Brozek and John Larr to serve on the nominating committee. Chairman Gilbert also lauded the fine job of Frank Wandyes in preparing a pamphlet on "How To Become a Professional Engineer in Connecticut." Copies can be purchased for $.50 which covers the cost of mimeographing.

—Siles W. Becroft

London-St. Thomas Holds First Executives' Night

The first meeting of its kind staged by London-St. Thomas members, executives' night was held Oct. 21 at Cobblestone Inn in Byron. Close to 90 members and guests were on hand for the program.

Speaking to the group was J. Q. Holmes, production engineer, General Motors Research Center, Detroit. His topic was "Production Engineering Problems."

In his talk, Mr. Holmes explained the JIC standards, and how they are applied to assist industries in designing and building better machines. He also gave a short resume on the September machine tool show and described some of the various exhibits.

Al Trueman introduced the speaker, who was thanked by Lou Jensen for his discussion. *—Richard J. Merriott*

GERMAN TRADE ASSOCIATION EXECUTIVES VISIT ASTE—Accompanied by two interpreters and an American guide, a group of seven executives of trade associations in Germany recently visited ASTE national headquarters in Detroit. Part of a six-week tour of the United States to study the role of trade associations in industry, the stopover in Detroit enabled the visitors to learn about functions of the Society and its services to 32,000 members. In the photograph, Harry E. Conrad, back to camera, is shown giving information on ASTE operations.

Walter Raleigh, standing, addressed the Hartford Night audience on "Engineering Know-How and New England's Future." Shown with him at the speakers' table, from left, are: ASTE President Harry B. Osborn, Jr., Past President A. H. d'Arcambal, and Hartford Chairman J. J. Balciunas.

Hartford Night Draws Attendance of 350

Past President Irwin F. Holland, left, receives his past director's award from President Osborn.

Traditionally a big event in New England for ASTE, Hartford Night drew a crowd of 350 guests on Oct. 4 at the Bond Hotel. The guest list included many national ASTE notables.

After a brief welcoming address by Hartford Chairman Joseph J. Balciunas, Past President A. H. d'Arcambal took over proceedings as toastmaster for the evening. Mr. d'Arcambal was Hartford's first chapter chairman.

National President Harry B. Osborn, Jr., paid tribute to the determination of Connecticut industrialists who fought back after the devastating flood in August.

Dr. Osborn also had the pleasure of presenting past national director awards to two ASTE past presidents. Awards went to Hartford's Ray H. Morris who was ASTE president in 1943-44, and to Irwin F. Holland who was president in 1948-49, for their outstanding contributions to the Society.

Walter Raleigh, executive vice president of The New England Council, was the featured speaker of the evening. He gave an account of the industrial history of the area and predicted continued successful growth. *—M. S. Fogg, Jr.*

Frank Zagar Addresses Lima Chapter Members

"Jig Design and Operational Technique" was the subject of a talk given by Frank Zagar before 70 members and guests of the Lima chapter on Nov. 17. Mr. Zagar, president of Zagar Tool, Inc., illustrated with color slides various types of drill heads and jigs made by his company.

Lima chapter selected three past chairmen to serve on the nominating committee and report at the January meeting. They are Ray Schimpf, A. E. Feightner and Robert Fromson.

Harry H. Gotberg, vice president of Colonial Broach Co., addressed 65 members and guests on Oct. 20 at the Clemins Royal Pine Room. His topic was "Broaching Methods and Application."

—Donald McCain and Neil Lenninger

Francis T. Williams Becomes Professional Engineer

A tool engineer with The American Welding & Mfg. Co. in Warren, Ohio, Francis T. Williams has completed requirements for becoming a professional engineer in the state of Ohio. He is a member of the Western Reserve chapter.

Portland, Ore., Chapter Plans Special Meeting at Oregon State College

One of the most outstanding events of the year for Portland, Ore., members will take place Feb. 17 when they'll hold a special meeting at Oregon State College at Corvallis, Ore. Arrangements are being made by Prof. Milton C. Sheely, chairman of the chapters' education committee and also member of the college staff teaching industrial engineering. The college is acting as host for the program. Guest speaker will be George W. Gleeson, dean of the School of Engineering and Industrial Arts. His topic will be "Professional Background of Tool Engineers and What To Expect of Automation." Dean Gleeson has a background of 27 years in engineering education and is well-known for his work in engineering professional development.

Dean Gleeson

Another phase of the program will be a guided tour of the engineering plant facilities of the college.

Chartered buses will make the 85-mile trip to Corvallis, leaving the Portland bus depot at 6 p.m. on Feb. 17.

Visiting members will be most welcome and may write for further information to: Fred D. Mondin, superintendent, Willamette Iron and Steel Co., Portland, Ore. *—Walter L. Brenneke*

Rudy Torbico Addresses Nebraska Chapter Members

Rudy Torbico of the Carboloy Dept., General Electric Co., was the guest technical speaker at Nebraska chapter's Oct. 20 meeting. Mr. Torbico spoke to 31 members and guests on "The Carboloy Machinability Computer" at St. Anthony's Hall, Columbus, Nebr. *—Dean W. Roper*

Engine Plant Visited by Chautauqua-Warren

Two buses and several cars were needed Oct. 21 to transport Chautauqua-Warren members to Buffalo to visit the Chevrolet Engine plant there. Nearly 120 members and guests participated in the tour.

Ted Berg, chief inspector, greeted the visitors and assigned guides to small groups no more than 15. Supper in the plant cafeteria preceded the tour. *—William Keyes*

Philadelphia Hears Four Panel Speakers

Some 250 Philadelphia members were on hand for a panel discussion, "Carbide Throw Away Tips," presented by four speakers. With Bill Williams, consulting engineer, as moderator, participants were Erik Lund, Link-Belt Co.; John Marenchie, Met-Cut Research; John Smallwood, Landsdown Steel & Iron Co.; and Hall Fullum, C. H. Wheeler & Co.

Panel members agreed that one of the important advantages in using throw away tips is cost saving. It is more economical to discard the tip than recondition the conventional tool. Also, machine down time is less, and quality is easily maintained, together with less tool inventory and the absence of expensive grinding wheels. It has been proven that surface speeds up to 350 to 500 feet per minute can be used.

The closing part of the program was devoted to a demonstration of the Carboloy Electronic Computer by Mr. Monacelli, manager of development and application, Carboloy Dept., General Electric Co. —*S. A. Matthews*

Cemented Carbides Discussed at Pontiac

An up-to-the-minute talk on cemented carbides was presented by W. J. Loach at the October meeting of Pontiac chapter. Mr. Loach, vice president and general manager of Firth-Loach Metals, Inc., discussed factors that control the quality of cemented carbides. Fifty-two members and guests also had chicken dinner, compliments of Firth-Loach. —*D. C. Inman*

ROCHESTER — Chairman William B. Kamola presents a gift to Frederick H. Warren, assistant to executive vice president of General Dynamics Corp., who was guest speaker at the Rochester Oct. 10 meeting. Mr. Warren spoke on "Tooling up Atomic Energy's Future" before an audience of 200.—*Floyd Weed*

Sheet Metalworking Topic at Fox River Meeting

The latest methods in structural and sheet metalworking were presented by Dick Johnson and Joe Flamon, sales manager and engineer, respectively, for the Dries and Krump Mfg. Co., for members of the Fox River Valley chapter on Nov. 22.

Coffee speaker was Roger Barton, foreign representative of the Stephen-Adamson Mfg. Co., who gave some observations of industry in countries he has visited. Sixty-five attended the meeting.

On Oct. 25 Herman Goldberg, president of Snow Manufacturing Co., demonstrated high-speed production drilling and tapping with the aid of a drilling and tapping machine. —*H. L. Smith*

PHILADELPHIA—Examining an example of what is being done with modern cold forging techniques are: Jack Moorhouse, program chairman; Bob Friedman, vice president and general manager of National Machinery Co., and the chapter's November speaker; Dick Gross, chapter chairman; and Ed Wheeler, first vice chairman. In his discussion "Hot and Cold Forging," Mr. Friedman revealed trends in modern forging by the use of displays and films.

San Antonio Members Discuss Automation

"Automation" was the topic under discussion at a recent meeting of the San Antonio chapter. Ray King, sales engineer for Landis Tool Co., presented a film illustrating grinding operations on valves, crankshafts and journals, bearing rings and other parts used in the automobile industry.

Special guests at the meeting included M. M. (Bill) Wiseman, B. N. Brockman, Jr., and Paul Foxwell.

—*Stanley G. Gower*

Vice President McMillen Visits Evansville Chapter

Howard C. McMillen, national vice president of ASTE, was on the special guest list for Evansville chapter's executives' night on Nov. 14. Mr. McMillen as coffee speaker, outlined aims and goals of the Society.

The program held at Evansville College, featured the well-traveled exhibit and lecture, "Civilization through Tools," sponsored by The DoAll Co. C. G. Schelly, managing director of the Wilkie Foundation, outlined the evolution and history of tools for an audience of 172. —*William H. Brooks*

E. S. Cramer Reviews Uses of Abrasives

Northwestern Pennsylvania members met Nov. 3 to hear a talk on "Manufacturing and Use of Abrasives." E. S. Cramer, abrasive engineer, Norton Co., presented a film showing processing of abrasives from the mining to final bonding into various sizes and shapes of wheels. Assisted by Charles R. Garfield, he also described various uses and steps taken to improve safety in use of the wheels.

Selection of the nominating committee was made at the meeting, with R. O. Bishop, chairman, and L. J. Baumer and T. S. Smeal named to choose the slate of officers for next year.

—*Frank H. Grimone*

Design Engineer Speaks at Schenectady Meeting

"Springs and Spring Materials" was the topic of John B. Beckwith for his presentation at Schenectady's November meeting. Mr. Beckwith, design engineer for Wallace-Barnes Co., covered the manufacture of many types and shapes of springs and described their well-known and unusual applications.

He also related the effect recent floods had on production at the Bristol, Conn. plant. —*John A. Sheridan*

Ultrasonic Machining Discussed at Windsor

More than 150 members and guests met Nov. 14 to hear a talk on "Ultrasonic Machining of Hard Materials." Speaker for the evening was George Brown, sales engineer with the Ultrasonic Div., Sheffield Corp. His presentation included historical background, research and development of the process as well as production applications covering carbides, glass ceramics and any hard or dense material. A lively question and answer period followed. The meeting was sponsored by A. C. Wickman Co. of Canada.

In October, the Windsor chapter held its first educational night. One of the highlights of the meeting was the presentation of certificates to nine graduates of the chapter's education programs in tool design and die design.

Speaker at the session was John Sparrow, supervisor of apprenticeship training, Canadian General Electric Co. and a director of the Ontario Industrial Education Council. He pointed out the definite need for more skilled people in industry and what the Industrial Education Council is doing to aid manufacturers in establishing training programs in their plants to meet the future demands for trained personnel.

The meeting was sponsored by Bendix-Eclipse of Canada.

WINDSOR—Certificates to students completing the two-year courses in tool design and die design were presented by R. A. Ritchie, member of the National Education Committee. Pictured, from left, are: George Harrison, instructor, R. Gorman, E. Wilkes, K. Axelson, C. Couloufis, A. McLaughlin, L. Papp, M. Hollo, chairman of the chapter education committee.

Los Alamos Learns About Mining

Meeting at the Little Theater, Los Alamos members gathered Oct. 12 to hear a talk by Glen M. Buchanan. He showed slides and presented a lively discussion on "Mining in Alaska."

—John T. Jezek

Appointment Announced

H. Charles Yaeger has been appointed manager of manufacturing at the Pesco Products Division of Borg-Warner Corp. in Bedford, Ohio. He was previously factory manager of Jacobs Aircraft Co. in Pottstown, Pa. for three years. Mr. Yaeger is a member of the Lehigh Valley chapter.

Engineer Discusses Work Simplification

Granite State chapter's October meeting featured a discussion on work simplification by Sidney C. Peterman, supervisor of methods and planning subsection at General Electric Co.

Mr. Peterman's presentation included motions, methods, specifications, surveys, materials handling, plant layout, development of tools and equipment.

—Kenneth R. Stone

Piedmont Hears About Defense Mobilization

N. A. Olsen, director of the Metalworking Equipment Division of the Business and Defenses Services Administration of the U. S. Department of Commerce, was the special guest speaker at Piedmont's Nov. 7 executives' night. Approximately 150 heard Mr. Olsen describe a "trigger pool" system for defense mobilization, which would permit contractors to switch to defense production immediately when necessary.

Also on the program Mayor Marshall Kurfees of Winston-Salem gave a welcoming address, and Past Chairman A. F. Moosbrugger spoke briefly on the aims of the Society. K. P. Hanson, head of the Mechanical Engineering Dept. of North Carolina State College, announced a fifth year course in tool engineering, culminating several years of joint efforts by Piedmont education committee members Sid Jeffreys and Jim Huntley.

A nomination committee for officers was also elected and will include S. B. Jeffreys, E. J. Zagora and Frank Myers.

—Howard F. Blackwood

KANSAS CITY—Applications of the Carboloy Computer, pictured here, were discussed Nov. 3 by William L. Smith, second from right, representative of carboloy Dept., General Electric Co. Others shown at the meeting, arranged through Ellfeldt Machinery & Supply Co., are: Walter Gerhardt, William L. Enright, Walter Whitson, Bus Kimmerer, Warren Ricketson, Bill Brown, Paul Scardello, Bill Crosland, M. L. Smith and Bob Bryant.—*Gene E. Brunson*

Long Beach Members Hear T. E. Diehl

"Let's Not Build a Boat in the Basement" was the title of a talk given by Thomas E. Diehl of Douglas Aircraft Co., Inc., before an audience of 84 Long Beach members at the Lakewood Country Club on Nov. 2. He discussed the Long Beach Airport Runway expansion program, of vital interest to the Long Beach population.

Dan "Deacon" Toller, player for the Los Angeles Rams, spoke on professional football teams and players as coffee speaker.

—Jack Irby

Williamsport Members Tour Avco Corporation

Members and guests of the Williamsport chapter numbering 86 toured Williamsport Div., Lycoming Div., Avco Corp., on Nov. 14. The group got a firsthand view of modern high-speed machining methods.

Leo C. Williamson, director of public relations, addressed the members. Also participating in the plant tour were Louis Wilkinson, works manager; James Love, master mechanic; and John McBride, personnel director.

The nominating committee for officers was elected and consists of Joseph Gehret, chairman, William McCoy and Richard Huskin.

On Oct. 10 Howard Boyer, chief metallurgist for American Bosch Div., American Bosch Arma Corp., addressed the Williamsport chapter on "Selection and Heat Treatment of Tool and Die Steels." Coffee speaker was Thomas J. Donovan, past national director who discussed the benefits of ASTE membership and participation.

—Joseph Gehret

FAIRFIELD COUNTY — Henry Geer, center, student at University of Bridgeport, received a scholarship from the Fairfield County chapter. He is flanked by Dr. William P. Berggen of the university, left, and Edgar Mayberry, chapter chairman.

Fairfield Chapter Tours Brass Company

Following a dinner at the Hitching Post Inn on Nov. 2, 70 members of the Fairfield County chapter toured the Bridgeport Brass Co.

On Oct. 5 the chapter held its annual ladies' night at the Halfway House in Darien, Conn. George Wedberg of Fairfield entertained the group of 80 with a talk on "Music for Everyone."

—Henry E. Busby

Grand River Members Hear Murray McLean

A lecture on the technical difficulties encountered in refining the microstructure of high alloy steels to develop greater strength was delivered Nov. 4 at a meeting of Grand River Valley ASTE members. Speaking to an audience of 50, Murray McLean, metallurgical engineer with Atlas Steels, Ltd., also gave a forecast of future developments in steels.

A film was shown to illustrate discussion of alloy steels, their manufacture, analysis and character.

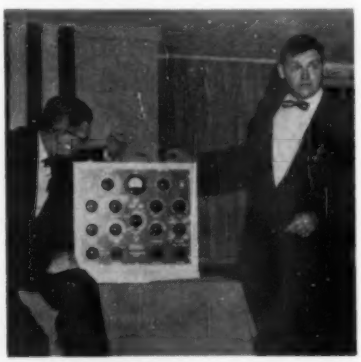
Introduced by Jim Sutherland, the speaker was thanked on behalf of the chapter by program chairman Jack Ward. The meeting took place at Shep's Hall in Galt. *—W. C. Little*

Springfield Visits Bauer Brothers Co.

A plant tour was on the Nov. 8 agenda for the Springfield, Ohio chapter. About 65 members visited the Bauer Brothers Co., manufacturers of attrition mills, separators, crushers, hullers, pulp cleaners, refiners and wire fabricators.

Welcoming the group was Ray Shouvlin, secretary-treasurer of the firm, who also gave a capsule history of Bauer Brothers and its present manufacturing operations. "Tooling for Wire Products" was discussed by W. A. Cannell who is in charge of tooling.

Preceded by dinner at the Rustic Inn, the tour also took visitors through the Bauer Laboratory where processes in the preparation of wood pulp being used for the manufacture of fiber-board were demonstrated. *—K. W. Keller*



LEHIGH VALLEY — Presenting the technical program at the October meeting were M. E. Rauss, left, and Thomas Hayes of Carboloy Dept., General Electric Co. Subject of the presentation was the "Carboloy Machinability Computer." Another highlight was the announcement that the 200th member had joined the chapter.*—Chauncey R. Kay*

Positions Wanted

PAST CHAIRMAN CANADIAN CHAPTER—age 39, widely connected with a successful background of 18 years in manufacturing administration and industrial relations. Present position works manager. Previously acted successfully as industrial sales manager, production manager, project development engineer, purchasing agent and tool engineer. Desires challenging position of responsibility with progressive organization in Canada or the United States. Write to Box 061, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

ASSISTANT CHIEF PRODUCTION ENGINEER—capable of eventually handling top spot in old established metal products company. Must have experience in designing for manufacturing and assembly of small parts. Engineering degree not essential. No age limits for qualified applicants. Write to Box 059, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

CARBIDE TOOL SALESMAN—young ambitious engineer with interest in selling and with carbide or machine shop experience wanted for eastern district position has good future. Good company benefits. Send resume to Box 064, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

REPRESENTATIVES WANTED—available, a complete line of Mist Coolant Systems. Territories open in many industrial areas. Brier Mist, 717 S. Boulevard, Oak Park, Ill.

MANUFACTURING ENGINEER—graduate M.E. Know mass production of small sheet metal parts and assemblies. Experienced in cost reduction analysis and procedures. Provide cost estimates to include tooling, fabricating outputs, machine selection on new and current projects. Be capable of suggesting design changes resulting from review of manufacturing tolerances, drawing dimensions and related functions of parts. This is an excellent opportunity with a progressive organization. Include detailed resume and salary requirements in first letter to Schlage Lock Co., P. O. Box 3324, San Francisco 19, Calif.

SALES ENGINEERS AND DEVELOPMENT ENGINEERS—long established central New England machine tool manufacturer has openings for sales proposal and development engineers. Sound opportunities for men with engineering background experienced in machine tools or closely allied fields. Salaries open; advancement dependent on demonstrated ability. Liberal vacation and benefit program provided. For further information, send complete details of background to Box 063, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Santa Clara Hears Edward Turkington

"The Small Business Administration —What It Is and What It Does" was discussed Nov. 15 at a meeting of Santa Clara Valley members. Speaking to the chapter was Edward Turkington, director of the Small Business Administration office at San Francisco.

He covered the growth, problems and need for small businesses in the United States and also related what the Small Business Administration is doing to nurture the growth of private enterprise in the small business group.

In October, Santa Clara members met with Golden Gate chapter to hear a talk on "The Hydrospin Process." Program speaker was Charles R. Heimlich, field engineer, Process Machinery Div., Cincinnati Milling and Grinding Machine Co.

H. Dale Long Visits Tri-Cities Chapter

Making a guest appearance at the Nov. 9 meeting of the Tri-Cities chapter, National ASTE Treasurer H. Dale Long presented past director's pins to Otto Reller and John Gilchrist. Mr. Long also gave a brief talk on the national organization and its function in serving individual members.

The technical speaker was Harry Deerwester, sales engineer for the Elox Corp., who presented a film and talk on electrical discharge machining.

—Don Shewry

Central Pennsylvania Host to Welding Society

Meeting with members of the York Welding Society, Central Pennsylvania chapter met Nov. 2 to hear a lecture on automatic welding. Speaking to the group of 150 was Robert A. Stone of the Air Reduction Sales Co., who discussed the development and use of special machinery for automatic welding. The session was held at the ASTE chapter's new meeting place, Lincoln Woods Inn.

Appointed as members of the nominating committee were D. A. Schrom, chairman, and B. C. Stambaugh and Raymond Meckley. *—Paul F. Leese*

Baltimore Member Forms New Company

Neil Heller, membership chairman of the Baltimore chapter, has formed his own company under the title of Neil Heller & Co. The firm will represent sixteen machine tool companies. Mr. Heller was formerly an abrasive specialist with Carey Machinery and Supply Co., Inc.

PITTSBURGH — The only woman to complete the education series on carbide tools was Miss Katherine White, shown here receiving her certificate from Dr. W. J. Jones, vice president of Carnegie Institute of Technology.

"Hydrospinning" Topic at Seattle Meeting

So high was interest in the Oct. 25 "Hydrospinning" talk given for Seattle members that a 40-minute question and answer period followed. Speaker was Charles R. Heimlich, field engineer for Cincinnati Drilling and Grinding Machines, Inc. Mr. Heimlich showed slides which demonstrated how new products such as jet engines lead to development of new machines to reduce fabrication costs. *—Harold F. Hanson*

Elected President

The board of directors of the Borroughs Manufacturing Co., Kalamazoo, Mich., a subsidiary of the American Metal Products Co. of Detroit, announces the election of George Bennett as president. Mr. Bennet, a member of the Kalamazoo chapter, was formerly general manager of the company.

237 Complete Carbide Series at Pittsburgh

Final session of Pittsburgh's educational series on carbide tools was held Nov. 4 in conjunction with the chapter's regular monthly technical session. A total of 330 persons was on hand to witness the presentation of certificates to those who had completed the series by Dr. W. N. Jones, vice president, Carnegie Institute of Technology. Certificates went to 236 men and one woman.

Dr. Jones spoke briefly on the subject "Education Is a Continuing Process." He was introduced by education chairman W. T. Mercier.

Another talk was given by M. O. Backstrom, assistant manager of carbide sales at Firth Sterling, Inc., who spoke on "Use of Carbides in Metal-Cutting and Forming Operations."

—E. L. Caughey

Milwaukee Host to Neighboring Chapters

ASTE members of Madison, Fond du Lac and Racine chapters were special guests at Milwaukee's November meeting, with a total attendance of nearly 350 on hand for the program.

Held at Allen-Bradley Co., the evening's agenda included dinner, sports films and entertainment provided by a hypnotist.

According to a recent announcement, Milwaukee's second vice chairman, Hans Frunmer has been named manager of a division of Caterpillar Tractor Co. in England. He was formerly production manager of the Trackson Co., a subsidiary of Caterpillar Tractor Co.

—Walter Behrend

MILWAUKEE—A tour of Allis-Chalmers Mfg. Co. was made recently by 170 ASTE members in Milwaukee. Company guides took small groups through the foundry, tool-room electrical shop, machine shop of the tractor division, final assembly of tractors, and the testing department.

LITTLE RHODY—Examples of type of work the impact grinder will produce were given out at a recent meeting by program speaker Ralph M. Moschella, right, manager of Sonic Products Div., Raytheon Mfg. Co. Receiving a set of cuff links and tie pin is Frank Delucia, program chairman. Others pictured, from left: Karl Friedland, secretary; Paul Watelet, first vice chairman; and Phillip Peckham, chapter chairman. *—Richard Kilbane*

MADISON—More than 200 attended the Oct. 20 meeting of the Madison chapter featuring "Civilization through Tools," sponsored by The DoAll Co. From right are: C. G. Schelly, managing director of the Wilkie Foundation; A. F. Griswold, first vice chairman; Chester Fredericks, second vice chairman; Arvil Mergen, secretary; Foster Hineline, vice president Gisholt Management Club; John Pikarski, Madison chairman; and Joe Markvaer, program chairman.—*Arnold E. Griswold*

DAYTON—With A. J. Maezer, far right, service engineer with Carboloy Dept., General Electric Co., as the program speaker, the Nov. 14 meeting featured a discussion of "The Carboloy Machinability Computer." Pictured with Mr. Maezer, from left, are: Frank Heberling, first vice chairman; S. H. Horn, Kansas City Carboloy representative; and Vic Boll, chapter chairman.

Automation Discussed by Saginaw Valley Speaker

Chief engineer at Hautau Engineering Co., Charles F. Hautau spoke on the question "What is Automation?" at Saginaw Valley's November meeting. He presented his discussion with the assistance of a projecting arrangement which threw his sketching and writing on a screen as he went along. A question and answer period was included.

In October, Carl Oxford, Jr., research engineer with National Twist Drill Co., was the featured speaker. After his program, written material recapping his speech was distributed.

—Kent B. Arnold

Quality Control Talk Given at Hendrick Hudson

Speaking to more than 70 members at Hendrick Hudson's November meeting, Charles W. Quillen discussed the subject "Quality Control and the Tool Engineer." Mr. Quillen is supervisor of assembly quality control for the Ford Motor Co., Dearborn, Mich.

In addition to a number of visitors from Ford's operations at Green Island, a special guest at the meeting was Joseph L. Petz, chairman of ASTE's National Editorial Committee.

—Benet Ripin

Twin Cities Members See Touring Tool Display

DoAll Company's "Civilization through Tools" was the attraction at the Nov. 2 meeting of Twin Cities chapter. About 130 members were on hand to view the display and hear a talk on the development through the ages. Narrator was C. G. Schelly, managing director of the Wilkie Foundation.

Another feature of the meeting was the introduction of the chapter's past chairimen who were credited by present Chairman Robert M. Johnson for the success of the organization.

—Roy Wressell

H. V. Harding Addresses Dayton ASTE Members

"Electrical Discharge Machining" was the topic for Dayton's October meeting. Speaking to the chapter was H. V. Harding, technical assistant to the president, Elox Corp.

Color movies were shown which gave a number of representative jobs with explanations of the machining technique used, and how the process can be employed to do difficult and sometimes otherwise impossible machining operations. *—Robert Bleicher*

Jack Swisher Addresses Memphis ASTE Meeting

Representing Carboloy Dept. of General Electric Co., Jack Swisher was the technical speaker at the Nov. 11 meeting of Memphis chapter. He spoke on "The Carboloy Machinability Computer," using slides and demonstrations to show advantages of the computer.

As part of the program to increase attendance, two awards were made at the meeting. Recipients were Logan Williams and Ralph Schuring.

The preceding meeting of the chapter featured a talk by John Harrington of DoAll Co., who showed a film and discussed the fine points pertaining to "Crush Form Grinding." The use of the diamond and the proper method to dress grinding wheels were described thoroughly. *—Ralph Schuring*

BENTON HARBOR-ST. JOSEPH—R. Paul Schreiber, center, of Dow Corning Corp., spoke on "Silicones as Engineering Materials" and showed a film on "What is a Silicone?" at a recent meeting. Assisting him were Warren J. Bush, left, of Dow and Robert Potter, right, program chairman.—*Orvis L. Johnson*

Speaker Moscaret, left, with Hamilton Chairman F. C. Johnson.

F. R. Springer Speaks to Binghamton Members

Francis R. Springer, eastern regional supervisor for Denison Engineering Co., was the guest technical speaker at Binghamton chapter's Nov. 2 meeting. He spoke on "Application of Modern Hydraulics in Industry." This meeting was designated as "100 percent night," and attendance of 197 members was gratifying. *—Glyn Williams*

Die-Casting Discussed at Kalamazoo Meeting

"Modern Die-Casting—Its Place in Industry" was the subject of a talk given by Robert C. Cornell for 60 members of the Kalamazoo chapter on Oct. 27. Mr. Cornell, vice president in charge of sales and engineering for Lite Metal Diecast, Inc., was assisted by David J. Walton, general manager of Du-Wel Metal Products. The two also displayed samples of intricate castings. *—T. J. Cook*

LOUIS JOLIET—Touring the plant of Scully-Jones & Co., manufacturers of precision holding tools, was the major attraction at the Nov. 15 meeting. Welcoming the group was H. Dale Long, president of the company and treasurer and national director of ASTE. After the tour of manufacturing facilities, a roast-beef dinner was served.
—Ken Hanks

Hamilton Members Hear E. J. Moscaret

"Machine Tools and Vibration" was the subject of a talk presented by E. J. Moscaret before members of the Hamilton chapter on Nov. 11. Mr. Moscaret, district manager of the Buffalo office of Consolidated Electrodynamics Corp., with the aid of slides, showed some of the application of vibration transducers which are used with oscillograph instruments.

He also showed the film, "Dynamic Measurements," which won the Oscarette award in 1954 for the best research engineering film.

Joseph Sheldon, chief tool engineer of the Massey Harris Ferguson's Market St. plant in Brantford, was welcomed back by Chairman Frank Johnson. Mr. Sheldon had spent several months in Australia giving instruction in Canadian implement methods.
—William A. Marcellus

Mohawk Valley Students Hold Recruiting Party

A social get-acquainted event was staged by the Mohawk Valley Technical Institute student chapter on Oct. 6 for prospective chapter members. Milo Eames, head of the mechanical technology department, spoke on how ASTE would be of service to students, in or out of school. Nicholas Kinney, instructor in machine tool operations and faculty advisor for the group, told the purpose of ASTE and showed a film on aluminum.

THE TOOL ENGINEER, ASTE Data Sheets and other Society literature were made available for prospective members and before the evening ended, eleven freshmen had signed up with Secretary Vance Richards.
—Hal Curtis

Niagara Speaker Covers Cold Flow Process

A program on "Cold Flow Process and Pressworking" was presented to Niagara District chapter on Nov. 3. Gordon Sommer, chief development engineer, Clearing Machine Corp., was the featured speaker. His discussion, which was supplemented with a film on metal stampings to show the 'cold flow' of metal in the production of 90-mm shells, was heard by nearly 100 members and guests.

Coffee speaker was Edward Kennard, general manager of McKinnon Columbus Chain Ltd., who spoke on principles of industrial relations.
—William A. Yaeger

ENGINEERS' WEEK ACTIVITIES AT SANTA CLARA VALLEY—Plans are well under way for participation in National Engineers' Week, Feb. 19-25, with these representatives of engineering societies in the area of Santa Clara Valley in charge of the program. ASTE members serving with the group are Alan G. Dimond and William C. Lanyon (seated, fifth and sixth from left), and Frank Menard (standing, far right). Mr. Lanyon is head of the Engineers' Week Committee and Mr. Menard is chairman of the Santa Clara Valley ASTE chapter.

Machine Tool Vibration Subject at Portland, Ore.

New methods of detecting and analyzing vibration and metal failures with electrical impulse machine, was the subject of the Portland, Ore., chapter's Nov. 17 meeting. Eugene D. Pettler, field engineer for Consolidated Electrodynamics Corp., demonstrated recordings of stress and strain on permanent graphs.

The chapter also elected the committee for nominating candidates for officers. It includes Fred Mondin, Walter Brenneke and Ted Adrianoff.

One of the worst blizzards in Portland history faced members who attended the meeting. Even the speaker was two hours late arriving by plane from Seattle.

—Walter Brenneke

Student Chapter Tours Homelite Corporation

On Nov. 11 the student chapter of ASTE at the City College of New York visited the Homelite Corp. of Port Chester, manufacturers of chain saws, generators, pumps and blowers. The group consisting of 22 members, was conducted through the entire production of a handsaw from the development stage to final shipping, thereby visiting each department.

At the conclusion of the tour R. C. McDonald, vice president in charge of manufacturing gave some of the company's history. William Reber, chairman of the Greater New York chapter, spoke on the design of a new product from the idea to the production phase.

—Jack Tetielbaum and *Sheldon Chesis*

Racine Members View Tooling Exhibit

Meeting with members of the American Society for Quality Control, the Racine chapter viewed The DoAll Co. exhibit "Civilization through Tools" at the Nov. 7 meeting. Narrator for the display was C. G. Schelly, managing director of the Wilkie Foundation.

A few days later, 90 Racine members traveled to Milwaukee to participate in a joint dinner meeting with Madison, Fond du Lac and Milwaukee ASTE chapters. Following the dinner, a movie was shown, officers of visiting chapters were introduced and entertainment was presented.

—Alvin J. Michna

Western Reserve Visits GE Ohio Lamp Works

Some 75 members of Western Reserve chapter made a tour Oct. 25 of General Electric's Ohio Lamp Works in Warren.

Participants were impressed by the interesting operations involved in the making of filaments and the ingeniously designed semiautomatic machinery used to assemble the many types of lamps manufactured, the largest being 1,500 watts. The conveyor and packaging department proved interesting for its unique equipment, designed to promote quick and easy shipping.

—C. W. Ramsey

J. E. King Speaks to Springfield Members

"Cold Extrusion Is Shaping Up" was the title of a talk delivered by John E. King at the Nov. 14 meeting of the Springfield, Mass., chapter. Seventy-five members attended at DeMarco's.

Additional program highlights included a discussion of new products and machines at Stanley Home Products by Al Lefebvre, chief engineer at Stanley. Also Ken Blaisdell gave a short talk and demonstration on the use of air and air controls in automation as carried on by The Bellows Co.

On Oct. 10 Ray Olsen, sales manager for Shell Process, Inc., discussed Shell process casting before an audience of 100 members and guests meeting at the Ivy House.

—Allen M. Johnson

PEORIA—Working a sample problem with the Carboloy Machinability Computer, from left, are: F. Chalcraft, C. Rice, E. Boyer and J. Weller, program speaker from Carboloy Dept. of General Electric Co. Mr. Weller, addressing the Nov. 1 meeting of about 85 members, explained the use of the various parts of the computer during his discussion. The chapter's nominating committee was appointed Nov. 18 with E. Eiermann as chairman, and C. Tobin and R. Kolb as committee members.

—G. W. Wieland

SAN FERNANDO VALLEY—A combination program was featured at the Nov. 2 meeting. George Cook and R. D. McLeon, left and second from left, both of The Bellows Co., presented the film "Operation Push Button." Terry Allen and Paul D. Cornelius, second from right and far right, of North American Aviation, Inc., gave a discussion on springs and their applications. Chairman Keith Griffin is pictured with the program participants.—*Sam Schwartz*

ROCKFORD—Speaker at a recent meeting was Lawrence Jacobsmeyer, center, of Sackover Metal Processing Co. Shown with him are Alfred Oman, left, chapter chairman, and Les Monson, program chairman. Mr. Jacobsmeyer spoke on "Controlled Atmosphere Brazing."—*Les Teachout*

Cincinnati Members Tour Sheffield Corp.

Chartered buses took about 90 Cincinnati members to Dayton on Nov. 18 for a visit at Sheffield Corp. The evening's program included a technical session on the Cavitron and Sheffield flexible gaging equipment.

The shop inspection showed a full complement of machine tools from small surface grinders to a large hydraulic press for testing forming dies. One of the most outstanding features of the tour was the modern and well-equipped Eli Whitney Laboratory, which is isolated from the surrounding buildings and where temperatures are kept constant, with less than one half of one degree variation.

—*Barton M. Jones, Jr.*

Los Angeles Holds Executives' Night; 350 in Attendance

"In honor of those who have made notable contributions to the field of production through their recognition of the phases of tool engineering," Los Angeles chapter held its first annual executives' night on Nov. 10 in the Ambassador Hotel's Gold Room. More than 350 members and guests attended the meeting, including representatives of 35 industries.

Guest speaker of the evening was Walter Kassebohm, vice president of manufacturing, Marchant Calculator Co. His subject: "What Industry Expects of the Tool Engineer." Mr. Kassebohm was introduced by ASTE Vice President Wayne Ewing, head of Arrowsmith Tool and Die Co., who spoke on the topic "Why the Tool Engineer?"

Mr. Kassebohm's talk emphasized the fact that in our current technical and social revolution, striving for better products and personal gain, must include human engineering. He asked that the tool engineer strive for more efficient methods of production, and that the tool engineer's voice be heard at company policy-making and administration levels.

"Industry should better recognize the ability of the tool engineer and encourage him to plan a refined product design for easier manufacture, utilizing better tooling processes and speedier and more accurate tool uses," Mr. Kassebohm said. —*Roland Hamel*

"Frozen Mercury Process" Discussed at Monmouth

Its first technical session since being chartered, the Oct. 18 meeting was held at Fort Monmouth, with close to 120 members and guests attending. The technique of frozen mercury investment casting was presented by Nelson G. Spoth, vice president, and Meacham Hitchcock, assistant sales manager, of Kolcast Industries, Cleveland, Ohio.

Illustrated by color slides and dramatically demonstrated by actually making the frozen mercury investments and pouring the molds, the technique often produces uncastable products, according to the speakers.

As a change of pace, Mr. Spoth presented Chairman John L. Webster with a gold-plated, suitably engraved plaque to be awarded annually to that member making the most outstanding contribution to tool engineering.

In November, the chapter saw a film and a series of colored slides on investment casting. Speaker was William Sweeney, vice president of Arwood Precision Casting Corp., who spoke on investment casting. —*Harry Williamson*

ELMIRA—Robert Callard, center, Corning Glass Works, discussed the applications of glass to present day tooling at the Nov. 7 meeting. Shown with the speaker are Chairman Francis Shepard, left, and Arthur Green, first vice chairman.—*John F. Puro*

PATERSON — James McCann, center, was honored recently with the "most valuable member" award for his contribution of service to Paterson chapter. Pictured with him are Charles Bazaz, past chairman and head of the constitution committee, and Conrad Corsini, editorial chairman.—*B. N. Kluger*

HOUSTON—Raymond King, center, spoke on "Automation" before an audience of 120 at Houston's November meeting. Shown with Mr. King from left are: Homer Briggs, past chairman; S. E. Rees, secretary; J. W. Hindman, chairman; and J. D. Bailleres, first vice chairman.—*George Bo-Linn*

Tool Exhibit Seen at Nashville

Sponsored by the DoAll Co. the now-famous exhibit, "Civilization Through Tools," was presented to members and guests of the Nashville chapter on Nov. 22 at the Noel Hotel. Traveling with the exhibit, C. G. Schelly, managing director of the Wilkie Foundation, lectured the group on man's achievement through the use of tools from earliest times to the present.

—*Bailey F. Moore*

St. Louis Members Hear Dr. Nathan Kohn, Jr.

Approximately 120 members and guests of the St. Louis chapter were on hand when Dr. Nathan Kohn, Jr., delivered a talk on "The Human Factor in Production," Director of Nathan Kohn, Jr., and Associates, personnel and consultants, pointed out that machines improve technologically, but that people who still run them are the margin for error.

Dr. Kohn discussed his work with individuals, companies and agencies regarding psychological research, personnel appraisal, attitude and motivation studies, and psychological testing.

—*Wilfred C. Graeler*

Golden Gate Visits Kaiser Aircraft Corp.

A trip to Richmond, Calif., for a tour of Kaiser Aircraft and Electronics Corp. was made by more than 100 members of Golden Gate chapter. The visit was preceded by a dinner and selection of three past chairmen to serve on the nominating committee. Serving with Chairman D. A. Gustafson are Ted Rohrer and Dean Roulund.

Technical speaker at the tour-meeting was Arthur S. Reinhart, assistant to the general manager at Kaiser.

—*John E. Wilson*

Vice Chairman R. W. Good, left, is shown with speaker Joe McKinsey.

Fort Wayne Members Hear Talk on World Travel

With color films for illustration, Joe McKinsey of Peterson Steels, Inc., presented Fort Wayne's November program on "Around the World on Wings of Sails." Mr. McKinsey recently sailed around the world aboard the ship, Brigantine Yankee, with a group of 30 others on a seven-month trip.

On the business side, Chairman Joseph A. Deck appointed members to serve on the chapter's nominating committee. Selecting the next slate of officers will be: Charles A. Haugh, Donald D. Welbaum, Everett R. Keese and Blaine Garard. —*R. H. Bienz*

Northern New Jersey Meets with Carbide Group

Meeting with members of the Carbide Society, members of the Northern New Jersey ASTE chapter heard a talk made by Hans Ernst, director of research at Cincinnati Milling Machine Co.

Speaking on machining economics, Mr. Ernst developed in detail the various factors determining economical machining and the ways the factors can be controlled to permit greater profits.

Before the technical meeting, a session on professional engineering was conducted by Anthony Cuoco who covered the advantages and requirements for obtaining a license in the state of New Jersey.

—*S. W. Haas, Jr.*

Technical Papers Distributed by ASTE to 150 Schools, Colleges

Free distribution of bound volumes of the 1955 Collected Technical Papers to 150 schools, colleges and universities has been announced by the ASTE National Program Committee. The 347-page books offer all of the papers and panel discussions presented at the Society's 23rd annual convention held at Los Angeles.

The volume, which is available to ASTE members at the price of $5, covers 16 separate lectures, four panels and an ASTE Research Fund report on workpiece temperature distribution. A total of 36 papers are included.

A variety of essential subjects are discussed, including among others: the use of magnesium for low-cost tooling; coding and classification systems; cold steel extrusion tooling; ceramic parts and tooling for mechanical applications; heat treating steel and aluminum; equipment leasing; and the setting of automation goals.

Members may get their leatherette bound volumes of these technical papers by writing to: Collected Papers, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich. Checks or money orders for $5 should accompany all requests.

Don't forget to send us a letter, card or change of address form as soon as your plans to move are definite. Include both your *old* and your *new* address. Notify: The American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.

ASTE's Program Kits Utilized for Audiences At Schools and Plants

Judging by the number of requests for Authorized Technical Program Kits, the unique series is proving to be particularly popular with schools, colleges and universities, as well as industrial firms with up-to-the-minute training programs.

Two Complete Programs

Prepared by the ASTE National Program Committee, the kits offer complete material for two programs—"The Forces in Single Point Tool Metal-Cutting" and "Process Analysis and Control."

To date, more than 1,500 persons have witnessed the programs, and demand for the kits has necessitated purchase of ten additional sets of visual aids to be circulated along with other prepared material.

Each program is designed for presentation to an audience by any qualified individual in the field of engineering. Kits are complete with: a speaker's manuscript; visual aids (slides or film); and free copies of printed material for distribution to members of the audience.

Subjects Covered

The program on "The Forces in Single Point Tool Metal-Cutting" requires 42 minutes delivery time and is illustrated with 2 by 2-inch colored slides.

It discussed the purpose of the various basic tool angles, chip types, how to change from a poor to a better chip type, force requirements and their relation to cutting variable, hardness as a measure of machinability, advantages of higher speeds, and total piece cost versus permissible tool costs.

The second program, "Process Analysis and Control," covers the detailed planning for the production of a typical mass-produced part. All possible methods are described to paint a true picture of production planning psychology. A 35mm color film strip illustrates the discussion. Delivery time is about 50 minutes.

How to Order

There is no charge for the use of the kits, with the exception of return postage and insurance on the slides or film. Requests should include the time and place of showing, shipping instructions (allow at least three weeks delivery time), and the estimated number of program copies needed.

Requests should be sent to the ASTE National Program Committee, 10700 Puritan Ave., Detroit 38, Michigan.

W. M. Buttriss, L. H. Flora and Homer Chapek address Canton members.

Canton ASTE Members, Local AIEE Meet Jointly

A joint meeting of the Canton ASTE members and the Stark County chapter of AIEE was held at the Moose Lodge in September. Following a buffet luncheon, two speakers from Tinnerman Products, Inc., addressed members of both organizations.

W. M. Buttries, sales promotion director of Tinnerman, discussed the advantages of engineered fasteners and histories of great savings made through elimination of materials handling. He also showed a comprehensive film on the production and uses of Tinnerman speed nuts.

In turn, L. H. Flora, director of sales for Tinnerman, spoke on design and production of engineered fasteners.

Rounding out the program, displays of products made by many of the local companies were exhibited so that members and guests could view them after the technical presentation was concluded. *—Clifford C. Smith, Jr.*

Dr. C. R. Austin Speaks at Monadnock

Speaking on the subject "Meehanite Castings Serve All Industry," Dr. Charles R. Austin addressed members of the Monadnock chapter on Nov. 17. Dr. Austin, assistant to the president of Meehanite Metal Corp., outlined the advantages of the Meehanite alloy for industrial use.

Dr. Austin pointed out that "Meehanite" bridges the gap between cast iron and steel, having good machinability, as well as wear, heat and corrosion resistant qualities. He explained that "Meehanite" is composed of pearlite through which finely flaked graphite is evenly dispersed, the pearlite giving the alloy long-wearing and elasticity and the graphite making it easy to cast and machine. There are 43 Meehanite foundries in the United States and Canada, according to Dr. Austin.

On Oct. 27 Carroll E. Miller, chief design engineer for Cone Automatic Co., spoke on "Interesting Developments in Conomatic Operation," and showed slides of the "Six Spindle Automatic." Membership pins were presented to Robert Gangenbach, David Kusciemka and Leon Loos.

—Maurice D. Towne

MONADNOCK—Past Chairman James McHoul, left, is shown with the chapter's newly elected treasurer, Earl C. Quimby, Jr.

DETROIT—This panel of experts gathered at a recent meeting of the education section to discuss "Opportunities in Tool Engineering." From left: Prof. Robert E. McKee, chairman of the National Education Committee; Prof. H. G. Donnelly; Prof. G. E. Demoreat; E. A. Reed; and L. B. Roberts.

Executive-Educational Night Program Presented by Northern Massachusetts

Leaders in the field of engineering education, government officials and 180 members and guests participated in Northern Massachusetts chapter's Executive-Educational Night on Oct. 10.

Following dinner, a succession of distinguished speakers addressed the group at Memorial Hall in Athol, Mass. Chapter chairman Robert W. Huxtable started proceedings with a welcome and introduced all guests.

"Trends in Engineering Education" were revealed by George A. Marston, dean of engineering at the University of Massachusetts, main speaker. Dean Marston outlined curricula used at his university and stressed the importance to the engineer of an excellent working knowledge of English in order to express his ideas.

Also on the program, Frank E. Chase, superintendent of schools, Gardner, Mass., discussed "The High School and Industrial Relations."

Presenting industry's point of view, George E. Wilcox, chief engineer for the Hand Tool Division of Millers Falls Co., told what industry expects embryo engineers to have received from a secondary and college education.

Arthur J. Leary, chairman of the education committee, gave a report on educational activities of Northern Massachusetts chapter which has a scholarship fund; presents technical and trade magazines to schools and public libraries; promote guided tours of industrial plants in the area; furnishes speakers for high school career days, PTA meetings and other organizations; and promotes courses for employees' advancement and cooperates with educational authorities in selecting courses for students that are best suited for industry.

Other special guests at the head table were: Samuel J. Boudreau, Massachusetts State Representative, first Worcester district; State Senator Elizabeth Stanton of Fitchburg; John P. McGrain, supervisor in education, Massachusetts State Department of Education; and Frederick J. Teed, supervisor of teacher training, Massachusetts State Department of Vocational Education. *—Otto S. Nau*

Carbide Grinding Topic of Portland, Me., Meeting

Progress in electrolytic, electrospark and ultrasonic grinding was the subject of the technical session at Portland chapter's Nov. 18 meeting. Speaker was John W. Ripple, senior representative for the Carborundum Co. His specific topic was "What's New in Carbide Grinding." Included in the presentation was a discussion of high-speed metal bonded diamond wheels. Also present at the meeting were Frank MacLeight, Eastern sales manager for Carborundum, and Stanley Hyde of the Hyde Windlass Co., who gave the coffee talk. *—R. P. Chaplin*

SYRACUSE—National Director James Horne, second from left, presented an affiliate membership plaque to Carrier Corp., represented by Roland Hood, third from left, and H. F. Hodgekins, right, a member of Carrier's board of directors. Chairman Victor J. Fitting is pictured at the far left. Technical speakers at the meeting were A. R. Sinclair, commercial engineer at General Electric Co.; and Robert Metz, design engineer, King Laboratories—*Paul H. Hansel*

R. F. Cell and Phill Flemming, both of Bendix Aviation Corp., are shown at a meeting of the student chapter at the University of Kansas.

Kansas Students Learn Statistical Analysis

Speaking at the Nov. 10 meeting of the University of Kansas chapter, R. F. Cell explained how statistical analyses are used in industry to predict tool life, probably error in manufacturing processes, and quality of production by sampling inspection. Mr. Cell is a staff engineer with Bendix Aviation Corp.

One week later, the chapter traveled to Topeko, Kan., to visit the Goodyear Rubber Co. The two-hour tour took the visitors through all phases of manuacturing of tires.

—Charles E. Wright

Cost Reduction Methods Outlined at Toledo

"Factory Methods, Time Study and Production Control" was the subject of Toledo's Nov. 9 meeting. Addressing the chapter audience of 70 members was H. K. Keever, a partner in the New York firm of Stevenson, Jordan & Harrison, Inc.

Five areas for study in reducing costs were listed: setting up the machine; handling the piece; adjustments; machine performance; and measurements and checking. Mr. Keever pointed out that each step is thoroughly analyzed and concentration for cost reduction is on the operation costing the most money. *—Harold H. Krueger*

Named District Manager

George E. Smith has been named manager of the mid-Atlantic district of the Metalworking Div., Kennametal, Inc., according to an announcement by Bennett Burgoon, Jr., sales manager. A member of Philadelphia chapter, Mr. Smith had been sales application engineer with Kennametal.

Machinability Computer Demonstrated at Lehigh

"High Efficiency Machining and the Carboloy Machinability Computer" was discussed and demonstrated by Thomas Hayes for 65 members of the Lehigh Valley chapter on Oct. 21. Mr. Hayes, east coast service engineer for the Carboloy Department of General Electric Co., critically evaluated the wasteful practices of today and presented a method for coping with them.

He showed how the Carboloy Machinability Computer in a matter of seconds could calculate the effect of nineteen basic machining variables concerning machine performance, tool life and output, taking much of the guesswork out of machining.

John Koop, relatively new member of the chapter received a money award from Vice Chairman Kuba, for bringing in eleven members, one of which was the 200th.

—Chauncey R. Kay

H. E. Collins Visits Tucson Chapter Meeting

ASTE Vice President Harold E. "Rip" Collins was a special guest and speaker at the Nov. 8 meeting of the Tucson chapter. In his capacity as manager of foreign operations for the Huges Tool Co., Mr. Collins addressed the group on machines, fixtures and tool engineers abroad. He gave a personal account of machine equipment and exchange of ideas in the United States, and talked about engineering societies similar to ASTE who have 100 percent attendance at meetings.

On Oct. 4 Charles R. Heimlich, field engineer for the Process Machinery Division of Cincinnati Milling & Grinding Machines, Inc., was the guest speaker.

—Joseph W. Vincent

TUCSON — Principals at the Nov. 8 meeting of Tucson chapter were from left: Don Davern, chief tool engineer, Hughes Tool Co.; Harry McClain, chairman; and ASTE Vice President Harold E. Collins.

BINGHAMTON—Five past chairmen attended Binghamton chapter's 100 percent night on Nov. 2. From left are: Past Chairmen William Leindecker, 1953-54; Roger Cole, 1948-49; Jack Pangburn, 1945-46; William Mazer, 1946-47; and David Wiliams, 1954-55. Also from left are: Francis R. Springer, speaker; Henry Borror; and Philip Taylor, present chairman of the chapter.

Magazine Editor Presents Massachusetts Program

H. E. Linsley, associate editor of *American Machinist* magazine, was the program speaker at the Nov. 15 meeting of Southeastern Massachusetts chapter. He gave an informative talk to 100 members and guests on the topic, "Meaning of the Machine Tool," relating how mass production by machine tools has given our country the highest living standards.

At the October meeting, the chapter heard from Herbert Jahn, president of B. Jahn Co., who spoke on progressive die design.

—Karl N. Nittel

ASTE Director Richard Smith, right, presents an Southeastern Massachusetts affiliate membership plaque to Reed & Barton Corp., represented by Jack Fisher.

Louis Joliet Member Designs New Machine

J. Harvey Chandler, member of the Louis Joliet chapter, has been granted a patent on a machine which he invented that is attached to a gathering binder machine used in publishing firms. The machine counts and stacks accurately any predetermined number of magazines up to 125,000 pieces an hour after which they are ready for trimming or wrapping. Mr. Chandler is plant manager of the Folger Adam Co.

—Ken Hanks

Automatic Controls Topic of New York Program

Importance of automatic controls to assure maximum productivity from the operation of equipment and processes was discussed by Edward J. Reulbach, engineer, Industrial Div., Minneapolis-Honeywell Regulator Co., at a meeting of Greater New York chapter.

Chairman William F. Reber, Edward J. Reulbach and Warren Matlack.

He detailed basic principles of controls design and operation, from the most simple control design to the complex control regulator designs necessitated by modern conditions in difficult applications. Mr. Reulbach said that a knowledge of machine and process controls is important to the tool engineer because of his important role in achieving maximum production with minimum cost.

Coffee speaker for the evening's program was Maj. E. A. Kinard, USAF, who spoke on the increasing importance of aircraft in modern war strategy.

A progress report from the education committee indicates that courses in tool engineering may be available at accredited schools in New York next fall. The committee, with the sanction of the New York State Board of Regents, is actively seeking the support of industry and has formulated a program for securing financial support and participation of industrial personnel.

—Jean Nazeley

coming ASTE meetings

National

NATIONAL PROGRAM COMMITTEE—Jan. 4, Conrad Hilton Hotel, Chicago.

NATIONAL MEMBERSHIP COMMITTEE—Jan. 14, Jefferson Hotel, St. Louis.

NATIONAL EDITORIAL COMMITTEE—Jan. 28, National Headquarters, Detroit.

Chapter

BENTON HARBOR-ST. JOSEPH—Jan. 12, Schulers. "Shell Molding" by Otto W. Winter of Beardsley and Piper.

BOSTON—Jan. 12. Joint meeting with the American Welding Society.

CEDAR RAPIDS—Jan. 20, 6:30 p.m., Montrose Hotel. "Tool Cost Estimating" by Lawrence E. Doyle, professor of mechanical engineering at the University of Illinois and member of the ASTE National Professional Engineering Committee.

CHAUTAUQUA-WARREN—Jan. 19, 6:30 p.m., Carver House, Warren, Pa. "Current Ideas About Grinding" by Dr. Leo P. Tarasov, research and development department, Norton Co. Nomination and election of officers.

COLUMBUS—Jan. 11. Plant forum at General Motors Corp.'s Ternstedt Division.

DETROIT—Jan. 12, senior section, Father, Daughter and Son Night. Jan. 5, carbide section, General Motors Night. Jan. 19, education section, "Gear Production."

ERIE—Jan. 10, 6:30 p.m., G. E. Community Center. "How the Tool Engineer Can Use Silicones" by J. J. Wilson, sales engineer, Dow Corning Corp.

FOND DU LAC—Jan. 13, 6:30 p.m. Fond du Lac. Contact Al Buerosse of Fond du Lac for reservations.

FORT WAYNE—Jan. 11, 6:45 p.m., Hobby Ranch House. "Uses, Hardenability of Different Tool Steels" by a representative of Latrobe Steel Co.

GRANITE STATE—Jan. 17, 8 p.m., Rochester, N. H. "Plastics—Present and Future" by Raymond Carter, manager Plastics Div., du Pont Co.

HAMILTON DISTRICT—Jan. 13. "Flame Plating" by representatives of Linde Air Products Co.

HENDRICK HUDSON—Jan. 18, 6:30 p.m., Circle Inn, Latham, N. Y. "A Few Thoughts on Automation" by F. Steele Blackhall, III, vice president of Taft-Peirce Mfg. Co. Display by Frank A. Hart Co.

LANSING—Jan. 9, 6:45 p.m., Stevens T. Mason Bldg. Cafeteria. "Oil Hydraulics" by R. H. Krepps, sales manager of Denison Engineering Co.

LEHIGH VALLEY—Jan. 20, 8 p.m., Hotel Traylor, Allentown, Pa. "Optical Gaging" by representatives of Optical Gaging Products, Inc.

LITTLE RHODY—Jan. 5, 7 p.m., Johnson's Hummocks. "Air Applications" by Benton Larson, sales engineer for Bellows Air Equipment.

LONG ISLAND—Jan. 9, 8:30 p.m., Garden City Hotel, Garden City. "Broaches and Broaching" by representatives of National Broach & Machine Co.

LOUIS JOLIET—Jan. 17. "Hydrospinning Metal" by Kenneth W. Moore, Process Machinery Div., Cincinnati Milling Machines, Inc.

LOUISVILLE—Jan. 10, 6:30 p.m., Seelbach Hotel. Executives' Night. Guest speaker will be Howard C. McMillen, national ASTE vice president.

MID-HUDSON—Jan. 12. "Tooling for Automation" by Harry Conn, chief engineer, Scully-Jones & Co. Film to be shown, "Flood Around Pleasant Valley" by Joseph L. Petz.

MONADNOCK—Jan. 19. "Machining of Stainless Steel" by William Kemper of Carpenter Steel Co.

NEBRASKA—Jan. 19. Plant tour of American Meter Co., Nebraska City, Neb.

NORTHERN MASSACHUSETTS—Jan. 17, 7 p.m., Athol, Mass. "Controlled Air Power" by Harold Granger of The Bellows Co.

NORTHERN NEW JERSEY—Jan. 10. Educational Night. Panel session with engineering representatives from local colleges.

PHILADELPHIA—Jan. 19. "Grinding Seminar" by representatives of Landis Machine Co. and Cincinnati Machine Tool Co. Moderator will be Karl Rauch of SKF.

PIEDMONT—Jan. 9, Mayfair Cafeteria, Greensboro, N. C. "Machining of Stainless Steels" by William H. Kemper of Carpenter Steel Co.

PITTSBURGH—Jan. 6, 6:30 p.m., Gateway Plaza. "Automation—Principles and Applications" by W. C. Allen, director, manufacturing and equipment engineering, Westinghouse Electric Corp.

ROCHESTER—Jan. 9, 8 p.m., Barnard Exempt. "Gaging Problems and Their Solution" by R. L. Gergen, gage sales manager for Pipe Machinery.

SAN FERNANDO VALLEY—Jan. 4, 7 p.m., Hody's, North Hollywood, Calif. "The Use of Optical Equipment in the Tooling Field" by James Stolz, engineer for Opto Engineering Co.

SCHENECTADY—Jan. 9, 8 p.m., American Legion Post #21. "A Method of Reasoning for Tool Design" by J. I. Karash, production manager, Reliance Electric and Engineering Co.

SOUTHEASTERN MASSACHUSETTS — Jan. 17, Cotillion Room, Taunton. "Carbides" by Malcolm F. Judkins, chief engineer, High Temperature Alloys Div., Firth Sterling, Inc.

TOLEDO—Jan. 11, Maumee River Yacht Club. "Shell Molding" by Otto Winter, Beardsley & Piper Division.

TWIN STATES—Jan. 11, Springfield, Vt. Executives' Night. "Economics of Equipment Replacement" by representatives of Cincinnati Milling Machine Co.

UNIVERSITY OF KANSAS—Jan. 12, 6:30 p.m., 300 Fowler Shops. "Instrumentation for Automation" by Eugene Shapiro, field engineer for LeeMark Associates.

WINDSOR—Jan. 9, 6:45 p.m., Prince Edward Hotel, Windsor. "Automation in Presses" by Melvin D. Verson, executive assistant, Vernon Allsteel Press Co. Meeting sponsored by Rudel Machine Co., Ltd.

WORCESTER—Jan. 10, 7 p.m., Putnam & Thurston's. Past Chairman's Night. "Silicones for Engineers" by J. T. Duane of Dow Corning Corp.

ASTE Industrial Exposition and 24th Annual Meeting will be held March 19 through 23, 1956 at Chicago, Ill. The Exposition will be held at the International Amphitheatre.

Nominating Committee Elected by Long Island

The nominating committee for officers was elected by members of the Long Island chapter at their Nov. 14 meeting. It includes George Bennett as chairman, Alfred E. Fuchs and Richard Van Harken.

The technical portion of the meeting was presented by Frank E. Chase, New York district manager for the Consolidated Engineering Corp., who described the uses of various vibration pickups and associated equipment which may be used to analyze the performance of machine tools. Approximately 125 attended this meeting at the Garden City Hotel.

On Oct. 10 William H. Busch of Lodge & Shipley Co. used slides and samples to describe the Floturn Process, method of forming sheet metal, usually into a conical shape. Seventy-five were present.

—William H. Bruning

Chicago ASTE Speaker Reviews Plastic Tooling

Addressing the largest crowd of the year, 250 members, Lloyd J. Oye of Rezolin Inc., Los Angeles, discussed various types of material used for plastic tooling at Chicago's Nov. 14 meeting. After the lecture, five actual demonstrations showed the various methods of use.

On Nov. 18, the chapter traveled to Gary, Ind. for a tour of the Budd Co. plant. Members were guided through the facilities and shown the various operations in production of automobile bodies. *—L. B. Klemme*

Lansing Chapter Hears Harry Conn

When the members of the Lansing chapter met at the Stephens T. Mason Bldg. on Nov. 11, it was to hear Harry Conn, chief engineer of Scully-Jones & Co. In his address on "Tooling for Automation," Mr. Conn pointed out short cuts and enumerated many points to reduce down time. Seventy-two attended the meeting. *—R. J. Krumrie*

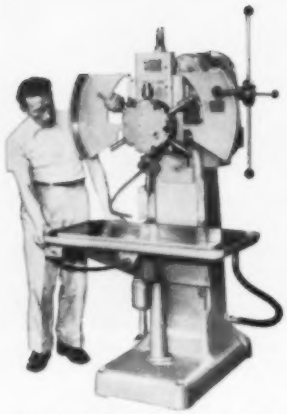
PURDUE UNIVERSITY—A recent speaker was H. Dale Long, president of Scully-Jones & Co. and also national treasurer and a national director of ASTE. He told a group of student members about the career aspects of tool engineering. Pictured with Mr. Long, center, are: M. Peterson, second vice chairman; L. Laudenschlager, secretary; N. Biteler, chairman; and J. McMillen, treasurer—*R. Burge*

FOND DU LAC—"Queens for a Night" was the title selected for the chapter's annual ladies' night meeting held Nov. 11 at Art's 151 Club, Manitowoc. Arrangements for the program, which included dinner, dancing and entertainment, were made by the members pictured here with their wives. Standing, from left: Paul Leeser, program chairman; Leonard Kaufman, chairman of local arrangements; and Henry Faith, chapter chairman. Seated are: Mrs. Leeser, Mrs. Kaufman and Mrs. Faith.

—Walter M. Gradolf

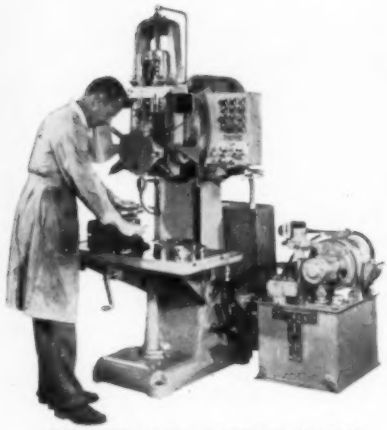
SOUTH BEND—Applications of the Carboloy Machinability Computer were discussed at a recent meeting by E. J. Monacelli, third from left, of Carboloy Dept., General Electric Co. Among the 75 members who heard his talk were, from left: M. J. Nowak, Martin Steenek, C. D. Berg, John R. Berker and Paul J. Roberts.

—David Herring

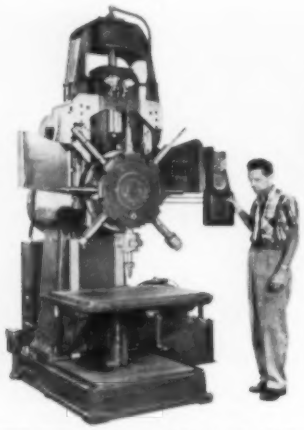


MODEL 2A—hand operated, 6-spindle

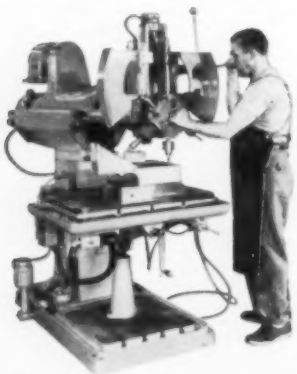
MODEL 2B—hand operated, 6-spindle



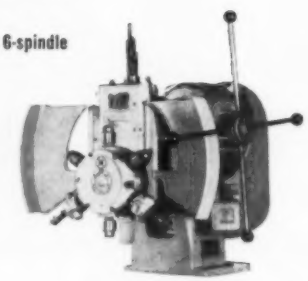
MODEL 2BH—automatic hydraulic, 6-spindle



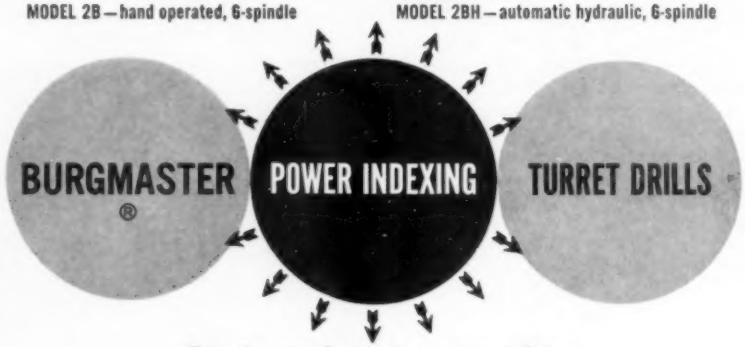
MODEL 3BH—automatic hydraulic, 8-spindle



MODEL 2BR—ram type radial, 6-spindle



MODEL NO. 2BF—flanged mounting; can be mounted in any position for special purpose set-ups



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The BURGMASTER Turret Drill is designed to eliminate a large part of wasteful handling which research proves takes up as much as 50% of machining time. Here, in one highly versatile machine, drilling, reaming, counterboring, countersinking, spotfacing, tapping, O. D. threading and numerous other secondary operations can be accomplished by one operator. Ease of setup and operation makes the BURGMASTER adaptable to very short as well as long runs of parts—a machine that will cut your second operation costs. We will be glad to send you specific information as to how this versatile machine can benefit your operations.

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PROGRESS IN PRODUCTION

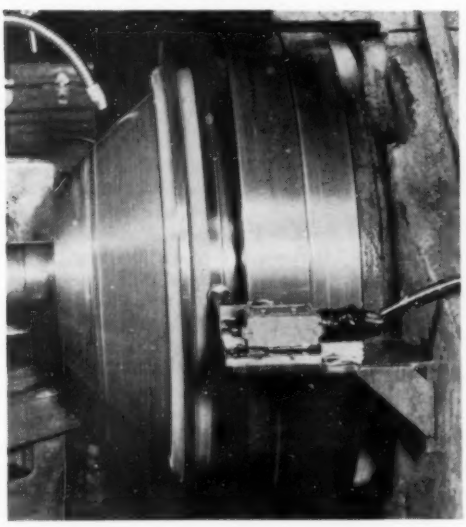
FLOW TURNING TECHNIQUE UTILIZED TO ACCOMPLISH DIFFICULT JOB

Adaptation of equipment plus engineering innovations have permitted utilization of the flow-turning process for what had been considered an improbable job at Ford Aircraft Engine Div. Complication arose from difficulty of flow turning the J-57 compressor chamber rear liner which has a bullet nose design. The technique, which is an outgrowth of spinning, involves cold flowing of metal to a specific shape over a hardened arbor.

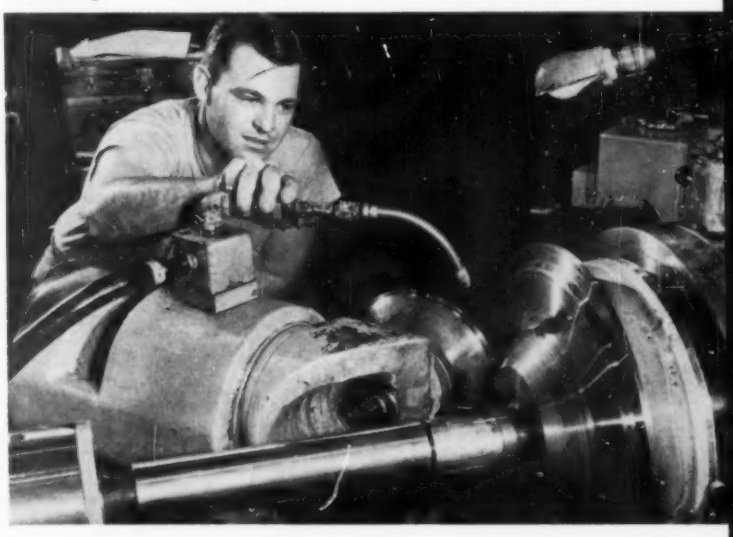
Engineers from Semi-Production (the company's trouble-shooting section) developed a contour attachment to be used with regular flow-turning equipment—result was a perfect piece part in one operation. This innovation, combined with additional designs of blanks, arbors and rollers, has brought about substantial scrap reduction, a 40 percent reduction in machining time and a superior quality finished product.

Proof of satisfactory results from the development is that currently, three other parts for the J-57 are being flow-turned, while schedules call for the technique to be used on an additional 23 parts in the coming year. At Ford Aircraft, results have been uniform, while tooling costs have been drastically reduced. Several conical parts, which have been considered impossible to

Closeup view shows flow turning of metal over a precision arbor. In a single operation taking less than two minutes, the flow turn machine forms a finished rear bearing support.



Flow turn operator adjusts a coolant nozzle over the roller as he prepares to flow turn a rear bearing support blank into a finished part. An hydraulic shaft holds the blank against the arbor under the tremendous pressure of the roller.



press with conventional dies because of metal fractures, have been successfully flow-turned.

According to the engineers, the most important phase of development preparation is design and machining of the blanks. This is mainly because the process is expected to produce a perfect finished part with no additional machining needed on the formed surface.

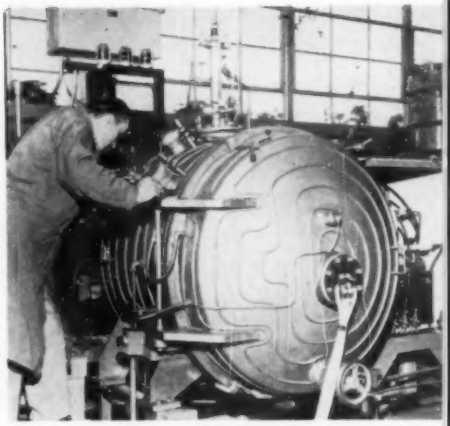
Second factor for attention is arbor design, followed by selection of proper roller. Final development involves rework on the roller, arbor and blank and proper adjustment of speeds and feeds.

Once developed, however, operation of the flow-turning machine is relatively easy for an operator to learn.

UTILIZE VACUUM MELTING FOR INVESTMENT CASTING

Versatility of the investment casting process may be considerably broadened with the introduction of vacuum melting, which will permit use of a wider range of alloys and provide greater strength and ductility to alloys currently being used. First of the vacuum melting furnaces designed specifically for this field has been put into operation on an experimental and pilot production basis by Austenal Laboratories, Microcast Div., at its Dover, N. J., plant.

Melting metals in a vacuum avoids harmful gases, undesirable oxides and slag compounds. In a standard melting process, appearance of those undesirable characteristics has limited investment casting to use of those alloys that remain either unaffected or are only slightly affected by those factors.



The first vacuum melting furnace designed specifically for investment casting has been put into operation by Austenal Laboratories. The furnace was supplied by Naresco Equipment Corp., Newton Highlands, Mass.

Already vacuum melting is being used widely in other segments of the metals industry such as in casting nickel ingots for the electronics field, or in production of high-carbon bearing steels or in melting high-temperature wrought alloys that normally suffer high oxidation loss.

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The largest gage illustrated is a carbide buttress thread plug gage of 5½" diameter—12 pitch. It serves as a good example of Lincoln Park's ability to meet special thread gaging requirements. Or, when customers' needs are for standard carbide thread gages, Lincoln Park offers a complete range of types and sizes.

The manufacture of thread plug gages has been a Lincoln Park specialty for many years. In fact, this company was the first to successfully utilize cemented-carbides for such products. It is this unequalled experience that assures you of gages of unquestioned accuracy and maximum service life.

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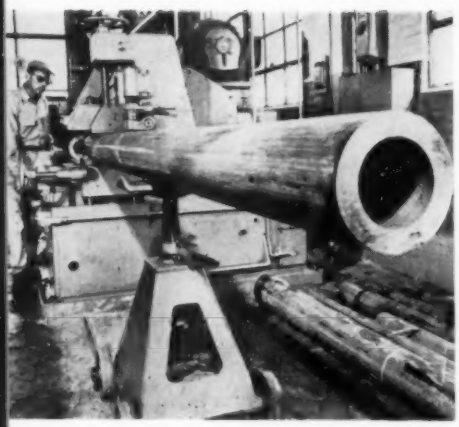
EQUIPMENT MAKES BIGGER CONTINUOUS CAST BRONZE

Advances in foundry technology now permit production of continuous cast bearing bronze in stock sizes ranging up to 9 in. in diameter. Previously, diameters of this material were available only as sand, permanent mold or centrifugal castings, and then only in 12 or 13-in. stock lengths. Now a variety of shapes, ranging from true round to more complex contours can be produced up to 105 in. long.

Industry, with its continuous need for bigger and bigger equipment, has demanded larger diameter bearing bronzes and bushings for economy and performance. Until recent installation of equipment capable of casting much larger diameter rods and tubes, the biggest diameters considered feasible were only 5 in.

The new stock is being produced by the Asarco method at the Barber, N. J., plant of American Smelting and Refining Co.'s continuous-cast products department. By this patented technique, molten bronze flows continuously into



First of 9-in. diameter continuous-cast bearing bronze is being cut to customer length on huge saw especially installed for this purpose.

water-cooled graphite dies, freezes, and emerges cast to size in the form of finished mill lengths. Because casting tolerances are close, only minimum machining is necessary.

Gravity fed, bottom-flow casting also avoids trapping of dirt and dross. Since no sand is used in the process, inclusions are avoided. Any foreign matter that may enter the system floats on top of the melt and is not carried into the product. At the same time, the finished casting is free from blowholes, porosity, or hard or soft spots because freezing occurs from the bottom up, and dissolved gases, freed during solidification, escape from the melt instead of being trapped.

GIANT TESTING EQUIPMENT INSTALLED AT LEHIGH

Installation of the largest universal testing machine in the world was celebrated with openhouse and dedication ceremonies at The Fritz Engineering Laboratory of Lehigh University.

The machine, which is being made available to industry for testing of all types of materials, is capable of applying both tensional and compressional loads up to 5,000 lb. Loads are applied hydraulically by means of a movable cylinder on a stationary piston 54 in. in diameter which is mounted on the bottom of the base. At maximum load, hydraulic pressure is 2200 psi. Two vertical screws, through which loads are applied are each 62 ft. long, 16 in. in diameter and weigh nearly 22½ tons.

Specimens of structures up to 40 ft high can be tested in tension above the sensitive crosshead or in compression below the sensitive crosshead. The base structure will accommodate structures up to 100 ft long, 40 ft high and nearly 10 ft wide for test loads.

The load measuring system is hydraulic and completely independent of the loading system. It consists of an Emery cell 56 in. in diameter, which is mounted in the crosshead, and a null-balance Tate Emery indicating system in the control console. Connection is through flexible tubing.

Accuracy of the load measuring system is guaranteed within ½ percent of dial reading. Six load measuring scales are provided, lowest of which has a capacity of 20,000 lb. On this scale, load variations as small as 20 lb can be indicated.

After three years of construction, a new seven-story building has been completed to house the giant testing machine and a dynamic testing bed featuring Amsler equipment. This equipment, made in Schaffhouse, Switzerland, consists of a completely integrated set of jacks, pumps and load measuring devices especially designed to apply and measure repeated loads on structures, structural members or machine parts.

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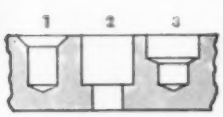
Believing that there is too great a void between standard and special tooling, Mohawk has designed and developed a semi-standard subland tool.

The Mohawk Size-Optional Subland is machined, hardened and placed in a stock bin. This results in a material saving to the customer in set-up costs, reduces delivery time to a fraction of that usually required for special tools, and allows a tremendous reduction in inventory. In ordering these Size-Optional Sublands, the customer is limited only in relation to shank specifications, and partially on overall length requirements. Diameters and step lengths are completely optional to fit the particular application. Write for full details.



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(2) Drill—Counterbore
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Now, Hy-Pro—the tap specialists and traditional leaders in tap quality—have developed a new and *exclusive* 3-way quality control. Here are the three steps:

The first is the industry's most advanced Heat-Treating installation, which guarantees you the hardest, toughest taps.

The second Hy-Pro marvel is its new Electronic Analyzer, which examines the structure of a tap without ever touching it. That's why Hy-Pro taps can produce more holes per tap at the lowest cost per tapped hole.

The third installation is Hy-Pro's new Micro-Hardness Tester. Hy-Pro taps are microscopically examined for metallurgical uniformity on both interior sections and surfaces.

And you get the benefit of these new Hy-Pro developments at no extra cost to you. Get in touch with your nearest Hy-Pro distributor, or call us direct. Hy-Pro costs no more.

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TOOLS of today

Slot Grinder

A machine for rough and finish grinding of various slots in soft or hard parts, offers several features to provide speed and efficiency of operation.

Among the features are automatic diameter compensation as the wheel is dressed. Spindle axis is automatically lowered so that periphery of wheel is maintained at proper depth in slots. Wheel diameter feeds directly in inches and thousandths as indicated on an easily read counter. Three in-and-out positions of the hand crank determine whether the dressing diamond moves, the wheel moves or both move.

A two-speed motor permits a surface speed of 12,000 fpm for roughing or 6,000 fpm for finishing.

Cycle control is arranged so that when set for roughing the wheel not only runs at high speed but also oscillates in a vertical direction to alternately plunge and relieve the grinding wheel. When set for finishing the cut, speed is reduced and the wheel feeds steadily. Pivot mounting of the wheel head provides both simplicity and long life.

Planet Products Corp., Cincinnati 27, Ohio. **T-1-1591**

Tube Bender

This compact, crank-operated Exactol tube bender is equipped with a worm gear device for easy, manual bending to exact tolerances. It handles annealed or ⅛H cold-drawn stainless steel tubing and is designed to enable the operator to produce bends up to 180 deg in one continuous smooth operation without strain or fatigue. The operating mechanism consists of one-piece frame provided with bronze worm wheel and hardened steel worm with ratio of 60 to 1.

Worm wheel drive, enclosed for safety and protection from external damage, disengages readily to allow quick return of the radius block after bending.

Slide block, furnished with bender, has grooves for six tube sizes: ¼, 5/16, ⅜, ½, ⅝ and ¾ in. OD. The bender can be clamped in a bench vise, or mounted in an adapter fastened to a work bench or to a mandrel support base.

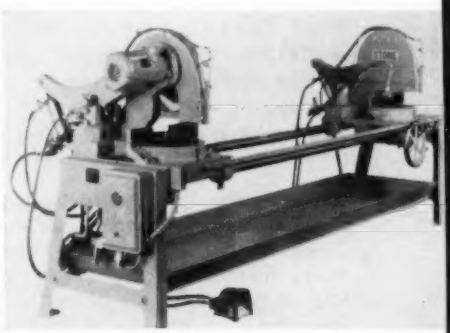
Each radius block has graduated markings to indicate degree of bend, and an integral arrangement for easy, quick, clamping of the tube.

Tube & Hose Fittings Div., Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio. **T-1-1592**

Double Cutting Machine

Lengths of metal ranging from 22 in. minimum to 102 in. maximum (special lengths on request) can be handled on a new Model DM-352 double cutting machine.

Nonferrous metals are cut with saw blades, and ferrous metals are cut with abrasive cutoff wheels because of the machine's two semi-independent heads that cut simultaneously. Either head may be positioned to make 90-deg cuts, or will cut at any degree up to and including 45 deg in either direction.



Power stroking of the cutting heads is air-actuated by a foot pedal valve with automatic return. Oil mist sprays lubricate the blades through each cut. When cuts are completed, the saw blades retract automatically into guards and the operator removes the cut section.

Two 3½-hp induction type geared-in-head motors power the machine. The motors, operating at 3450 rpm, are geared to 3200 rpm spindle speed.

Either 12 or 14-in. blades may be used with the machine. With the 14-in.

blades, cuts can be made from 1 x 6⅛ in. up to 3 x 7⅛ in. at 90 deg, and 1 x 4 5/16 in. up to 3 x 4⅛ in. at 45 deg. Larger cutting capacities are possible by ordering special straight edges set behind the two swivel points.

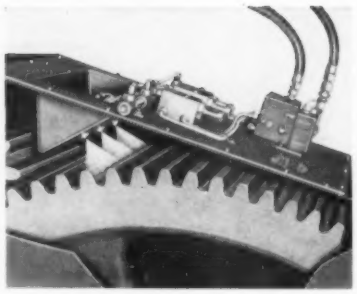
Stone Machinery Co., Inc., Manlius, N. Y. **T-1-1601**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Spray Panel Lubricator

Spray Valve Panels are designed to spray-lubricate bull gears, girth gears, such as on grinding mills and kilns, and other spur or herringbone gear trains.

Fastened to gear housings or framework, the self-contained panels spray the lubricant directly to the pressure side of the gear teeth. The panels measure approximately two feet by three feet. Central pumping units deliver gear lubricant at regular intervals



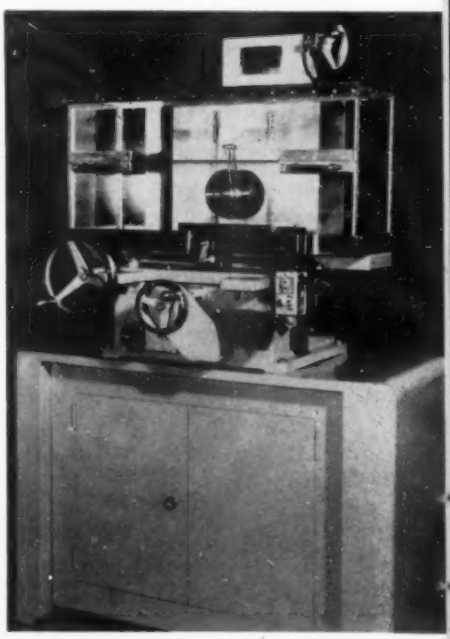
through a circuit of Dualine measuring valves which distribute the lubricant under pressure to the spray valves where it is mixed with air to form a penetrating spray which is then directed through built-in nozzles.

The Farval Corp., 3249 E. 80th St., Cleveland 4, Ohio. **T-1-1602**

Slicing Unit

A fully automatic addition to the Sanford grinder line is used for precision slicing and dicing germanium, silicon and quartz used in transistor and diode manufacture by the electronic industry.

This Micro-Matic precision wafering machine is equipped with control mechanisms and other automatic devices which, together with inbuilt accuracy, allow it to perform the functions of wafering and dicing semiconductor materials. Wafers are produced which are consistent in thickness according to any predetermined thickness ranging from 0.010 to 0.225 in. Parallelism is



Dickerman FEEDS PROFIT INTO *ANY* PRESS OPERATION!

Get faster production, constant performance, lasting accuracy with the feed that outlasts the die itself!

Whether you calculate unit profit by pennies or dollars, you can make more in less time with Dickerman Automatic Stock Feeds. Dickerman feeds operate 24 hours a day, if necessary — with no overtime — no fatigue — no production let-down — no chance of human error. Add automation to your press work — reduce unit costs — eliminate rejects — feed generous profits into every stamping operation! Twelve standard Dickerman feeds handle virtually any stock at any speed the tooling will withstand!

Dickerman

H. E. DICKERMAN MFG. CO.

324-201 Albany St., Springfield, Mass.

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controlled to within several ten thousandths variation. A 4, 5 or 6-in. diamond impregnated metal saw may be used for slicing and dicing.

Working capacity of the machine is 6 in. transverse, 12 in. longitudinal, and up to 12 in. vertical.

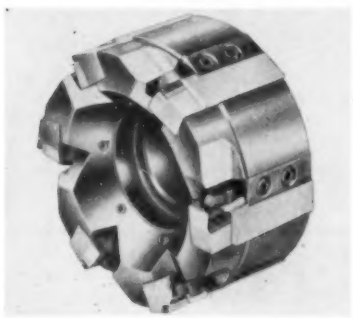
In one method, a saw cuts a wafer on both the advance and return strokes. In the second method, the ingot is fed to the saw which cuts only on the advancing stroke. In either case, action repeats until the ingot is completely sliced. The machine then stops for reload of work.

Micromech Mfg. Corp., 1020 Commerce Ave., Union, N. J. **T-1-1611**

Face Mill

A lifetime face mill body designed with built-in adjustments accommodates industry standard holders and "throw-away" carbide inserts to avoid any need for regrinding.

The low-cost disposable carbide blanks, each with six engineered cut-



ting edges, can be changed in seconds. With this cutter, down time is reduced to a matter of minutes. A new cutting edge is in place, automatically aligned to run and cut true, simply with the turn of a socket wrench.

Nelco Tool Co., Inc., Manchester, Conn. **T-1-1612**

Numerical Sequence Programmer

Automatic electronic numerical sequence programming equipment provides increased versatility for Monarch lathes and easily selected, fully automatic work cycles for volume production of precision pieces. Although presently arranged to actuate the Monarch 10-in. Series EE lathe, the equipment can be made applicable to any appropriate lathe in the line.

Key unit in the equipment is the electronic control panel which incorporates simple push type selectors to pre-

ACCO products

Wilson "Tukon" Micro Hardness Testers

A model for every range of pyramid testing
Model LR—Floor model for Micro and Macro Hardness testing
Model FB—Floor model for Micro Hardness testing only
Model MO—Table Model for Micro Hardness testing only

These "Tukon" models meet every fine test requirement

• WILSON "TUKON" Micro Hardness Testers are unexcelled for testing metallic and non-metallic parts such as fine wire, small precision parts, thin metal, shallow superficially hardened surfaces, jewels, plastics, glass, etc.

The three models pictured cover the entire range of diamond pyramid testing—with both Knoop and 136 degree Diamond Pyramid Indentors.

Proper selection of the proper model for your particular requirement depends on the type and thickness of work to be tested, range of loads, purposes for which the machine is to be used—research or control, other hardness testing equipment available and whether a combination of micro and macro hardness testing is required.

We invite you to consult with WILSON engineers on your hardness testing problem. There is no obligation. Write for **Booklet DH-114** *on WILSON "TUKON" Micro Hardness Testers.*

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Wilson Mechanical Instrument Division
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WILSON "ROCKWELL" and "TUKON" Hardness Testers

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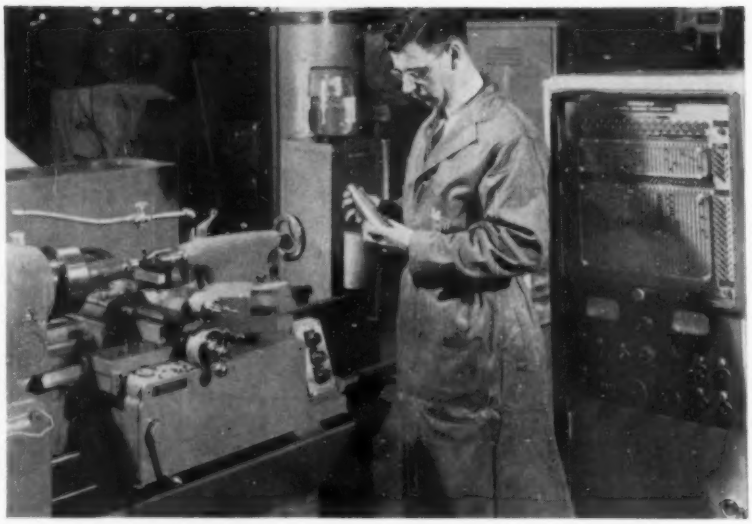
set various operations. Once the proper sequence is programmed, a touch of the "start" button sets in motion up to 5 automatic work cycles using as many as 5 varied spindle speeds and 5 different feed rates. Any number of identical workpieces may be turned in succession without further adjustment of the control panel.

Functioning in conjunction with the electronic control panel is an analog-to-digital converter connected to the machine's carriage motion. The converter sends electrical impulses to the control circuits at precise points in the automatic work cycles, thus actuating the selected operations. A simple, fast revision in the setting of the control panel selectors is all that is needed to change the program.

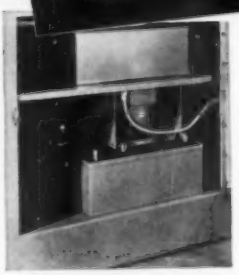
The electronic control panel and related electronic equipment are mounted in a special cabinet. Casters attached to the cabinet base enable the operator to move the unit. All electronic components housed in the control cabinet are arranged on removable plug-in chassis. This simplifies servicing and maintenance by allowing the quick installation of a duplicate chassis while a damaged assembly is repaired. As a safety measure, all plug-in chassis are electrically interlocked, so that the removal of any chassis from the cabinet will immediately shut off the machine.



The air gage tracer used with the numerical sequence programmer incorporates a dual template system which provides tracer control for both the last rough cut and the final finish cut. Shifting from the rough to the finish template is controlled automatically. Automatic positioning positive stops on the cross slide regulate rough cut depth during the automatic work cycles prior to actuation of the tracer control.

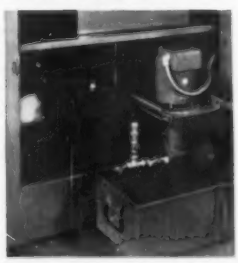
The Monarch Machine Tool Co., Sidney, Ohio.

Ruthman Gusher Coolant Pumps Are Adaptable



Illustrated is a Gusher Coolant Pump mounted on Beco Model #410 Automatic Drilling and Tapping Machine.

Photo Courtesy Batchelder Eng. Co., Inc.



Gusher Coolant Pumps readily lend themselves to novel and unusual applications. On the Beco Model #410 automatic drilling and tapping machine, the Gusher Coolant Pump is mounted on roller drawer slides for quick and easy exchange of coolants. On all coolant pump problems you can depend on Gusher Coolant Pumps.

THE RUTHMAN MACHINERY CO.

1810 READING ROAD CINCINNATI, OHIO

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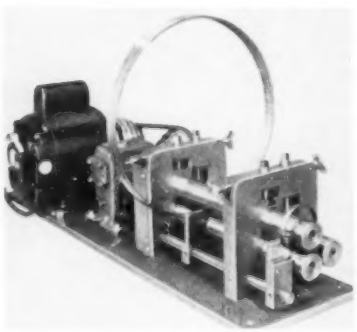
Ring Roller

Rings of round or flat wire from 2 to 30 in. in diameter may be rolled by the Penn wire ring roller. Power for the unit is from a ½-hp motor which



will take care of five ⅜-in. diameter wires. In operation, the unit will accomplish about the same amount of work formerly done by three hand rollers.

Penn Machinery Co., 117 N. Third St., Philadelphia 6, Pa. **T-1-1621**

Solid Lubricant

A recently developed solid lubricating substance remains useful at extreme temperatures and pressure ranges. It offers advantages for sealed and inaccessible bearings or assemblies; bearings adjacent to a surface that cannot be contaminated; intermittent, long-term operating mechanisms or parts where environment may affect organic lubricants. In addition it may be used where dust and solvents present problems.

The baked-on lubricant, called Meta-Film, forms a strong, unbroken film over any metal without affecting precision tolerances. It reduces metal friction with consequent increase of wear life.

American Metaseal of Detroit, 18666 Fitzpatrick St., Detroit 28, Mich.

T-1-1631

Drill Grinder

A simple, accurate adjustment for grinding drills to any included angle from 90 to 140 deg is available with Model DV Sterling drill grinder.

Changing the included angle is accomplished accurately by tilting the grinding wheel head instead of adjusting the work-holding unit. The angle adjustment is made by a hand wheel controlling a rack and pinion. A positive lock in the hand wheel holds the head at any angle.

A built-in clearance gage accurately indicates the clearance angle being ground on any size drill. A built-in diamond wheel dresser assures accuracy and high-quality finish. The operation is complete enough to make grinding the heels off by hand unnecessary.

This model DV has the same capacity as earlier Models DA and DB—2, 3 and 4-flute drills from $\frac{1}{8}$ to $2\frac{1}{2}$-in. diam. Because no chucks or collets are used, setup changes for different drill sizes take a minimum of time.

The Model DV Sterling drill grinder is powered by a $\frac{1}{2}$-hp, 115/230 v, single-phase, 3450-rpm totally enclosed motor.

McDonough Mfg. Co., Dept. TE, Eau Claire, Wis. **T-1-1632**

Sharpener for Carbide

Method X process of sharpening carbide tools by electrospark machining, rather than by abrasive wheels, may be carried out on the recently developed Style 43 sharpener.

Designed primarily for offhand sharpening of single-point solid carbide and carbide-topped tools, this machine functions without diamond wheels or abrasives. For a wheel, the machine uses a 10-in. cast-iron disk, connected to serve as the negative

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Even when labor was cheap and tools were costly, it was the best tooled shops that prospered. Now with wages higher and the work days shorter, it becomes imperative that every worker be supplied with every tool that will increase his hourly production.

See that each lathe, planer and shaper operator has the correct ARMSTRONG TOOL HOLDERS for each operation he performs. Equip each machine with its full complement of ARMSTRONG Setting-up Tools. Use better balanced, handier ARMSTRONG WRENCHES on machines and assembly lines. Specify ARMSTRONG Drop Forged "C" Clamps and Lathe Dogs . . . Today, only quality tools can be truly economical.

Write for an ARMSTRONG Catalog. It has page after page of production-increasing, cost-cutting tools.

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"The Tool Holder People"

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terminal of an electrical circuit. The tool is the positive terminal. A semi-solid dielectric film applied to the disk provides a spark gap of proper distance between those terminals. The single-pulse discharges which take place cause minute particles to be removed from the tool point. The resulting crater depth and diameter are proportionate to the energy discharged per pulse. Thus, rough or finish cuts are obtained by simply setting a power selector switch. Method X does not cause parallel or unidirectional tool marks, heat checks or grinding cracks.

Feature of the method is its capacity to work extremely hard materials, such as hard steels, cast alloys and the carbides, either singly or in combination. No coolant is used in the sharpening process.

Because the operation is much like conventional offhand grinding, an experienced grinder can quickly adapt his knowledge to the new technique.

Details of the tool sharpener meet NMTBA and JIC standards.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. **T-1-1641**

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Manufacturers of standard steel drill jig bushings, dowel pins, chamfer micrometer gauges, portable bench centers, roughness comparison specimens, hardened and ground parts and assembly to order.

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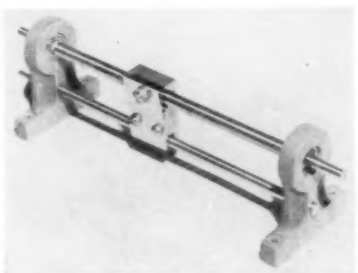
Die Lubricators

Reciprocating spring oilers for die set guideposts, consist of barrel-shaped coil springs $2\frac{1}{2}$ in. long that will compress to a solid height of $\frac{3}{16}$ in. Spring wire is completely covered with a tough, highly absorbent tubular wick. End coils are the same diameter as the guideposts, and the resilience of the spring wire presses the wick snugly around the post and oils it at every stroke of the press. The lubricators, called Die Savers, may be used in pairs or sets to accommodate long guideposts. To oil the very top of a post, Die Savers can be stretched considerably without impairing their usefulness. Reversibility provides double wear. Worn wick end may be pulled forward and the worn part snipped off to permit new contact.

William V. Heinz, 935 Hennepin St., LaSalle, Ill. **T-1-1642**

Lead Screw Assembly

Precision lead screw assemblies, identified as Type #X1, have been designed to provide a means of converting rotational motion into linear motion of a



carriage traveling along a shaft. The carriage can mount a pen, or indicator for display or recording purpose. Two assemblies are immediately available from stock: #X1-1 has 0.050 in. of

movement per revolution; #X1-2 has 0.0356 in. of movement per revolution. Other leads are available on request.

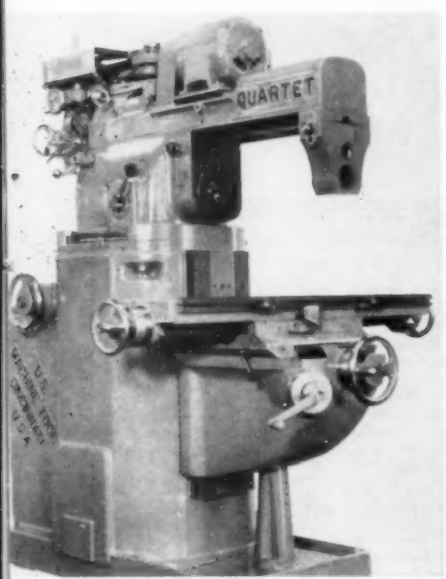
Units have Barden precision ball bearings of ABEC-7 quality and are made of stainless steel throughout except for hangers which are made of aluminum and anodized.

PIC Design Corp., 160 Atlantic Ave., Lynbrook, L. I., N. Y. **T-I-1651**

Universal Miller

A horizontal spindle, rather than the saddle and table, indexes for universal operations on a milling machine called the Quartet.

The massive turret, in which the spindle is mounted, may be swiveled



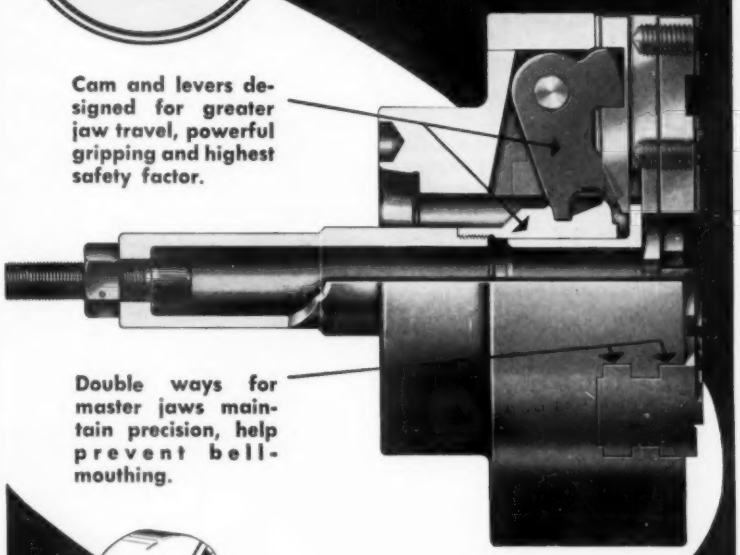
360 deg. When the unit is used as a universal horizontal miller, the spindle is indexed to the required angle. This feature provides unusual rigidity for precision work. The table retains its inherent stability, and the turret locks securely at the desired angle.

In addition to universal and horizontal operations, the Quartet will perform vertical and angular milling operations. Changeover from one type milling to another is fast and simple.

The machine has 30 in. of horizontal travel, 11 in. of cross travel, and 16¼ in. of vertical travel. The horizontal spindle has either a #40 or #50 taper and is driven by a 3 or 5-hp drive motor. The independently operated powerfeed vertical head is driven by a 1½-hp motor, mounted on the rectangular overarm.

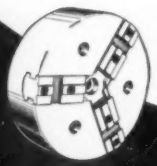
Rapid traverse powerfeed to the sad-

S-P POWER CHUCKS



Cam and levers designed for greater jaw travel, powerful gripping and highest safety factor.

Double ways for master jaws maintain precision, help prevent bell-mouthing.



More gripping power

Famous S-P cam and lever design holds the work tighter, permits cost-cutting heavy feeds and multiple cuts. Cam and lever design also resists opening of jaws by centrifugal force or diminishing air pressure . . . an important safety factor.

Installed as original equipment by Bardons & Oliver, Cleveland Automatic, Cone Automatic, Ex-Cell-O, Monarch, Warner & Swasey . . . many others.

Representatives in principal cities. Prompt deliveries. Send for Catalog 105. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.

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Piston packings "replace" themselves, cut downtime. Send for Catalog 105.

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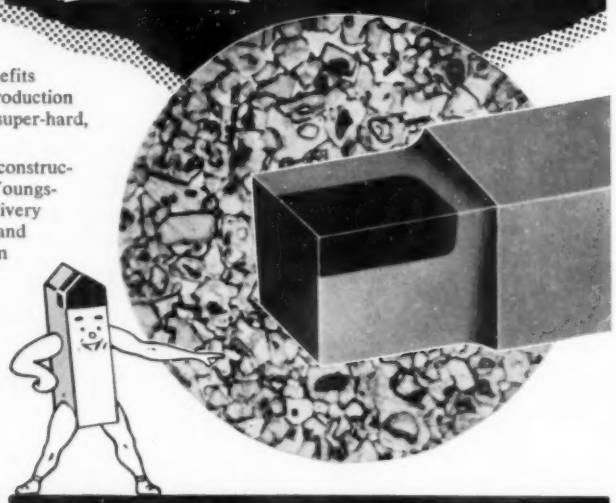
All Tools May Look Alike—But it's What's INSIDE That Counts

● An extensive, 2-year research program has produced a new series of Talide Metal grades having greatly improved hardness, strength, rupture-resistant and crater-resistant qualities. Users can now get maximum benefits from today's high-speed "automation" machines. Record production runs and continuous machine performance is assured with super-hard, super-tough Talide Tools.

● Universal acceptance of Talide Metal has made possible construction of a new 100,000 sq. ft. multi-million dollar plant at Youngstown, Ohio. Doubled production facilities assure prompt delivery and fast service. All Talide Metal grades are uniform and consistent in quality. They are processed in latest type vacuum electric furnaces under rigid laboratory control. Every test **proves** Talide is Best!



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TALIDE TOOLS GIVE TOP PERFORMANCE

40% more forgings cut at Automotive Engine Plant.

Part	C-1141 steel forging 1-1/2" dia. x 14" long.
Operation	Turning multiple diameters.
Machine	New Britain Chucking Lathe.
Tool	Talide triangular insert #TB-12123, Grade S-88 (Industry Code C-5), mounted in Klamp-Lok Toolholder.
Depth of Cut	1/8" to 3/32" R.P.M. 1540
S.F.P.M.	580 Lubrication None
Results	71 forgings machined per edge per grind compared to 49 machined with best competitive premium grades.

Double Production obtained at Electric Motor Plant.

Part	1040 steel pump shaft, Brinell 186.
Operation	Turning 3 diameters and 1 taper.
Machine	Sundstrand Automatic Lathe.
Tool	Talide triangular "Throw-Away" insert, 3/8" I.C. x 1/8" thick, Grade S-92, mounted in Klamp-Lok Toolholder.
Depth of Cut	3/8" Feed .021" S.F.P.M. 300
Results	31 shafts machined per edge per grind. Best competitive premium grade produced only 16 before fracturing. Exceptional toughness of Talide grade evidenced by only slight mushrooming of edge—no fracturing.

Call in a Talide sales engineer to recommend proper tooling for your machining operations, or write for 84-page catalog No. 56-G. METAL CARBIDES CORPORATION, *6001 Southern Blvd., Youngstown 12, Ohio.*

SEND FOR SPEED & FEED CHART—Pocket-size plastic chart gives complete information on speeds, feeds, relief angles and recommended grades for cutting all metals.

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TALIDE®
YOUNGSTOWN 7, OHIO

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HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

dle and table is standard equipment. The overarm is positioned through rack and pinion, and the vertical head may be tilted to the required angle by means of a conveniently located crank handle.

Infinitely variable horizontal spindle speeds range from 29-1450 rpm. Both the horizontal and vertical spindles may be used simultaneously and the machine may be operated while the turret is being indexed.

The U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati, Ohio. **T-1-1671**

Gear Shapers

Automatic operation features now available for the 1800 Series Shear-Speed gear shapers include automatic size adjustments to assure continuous operation, automatic loading, and a 3-way gear classifier and control panel for complete size inspection and size control of all gears produced. Various combinations using one or more of these components can be supplied to fit particular needs.

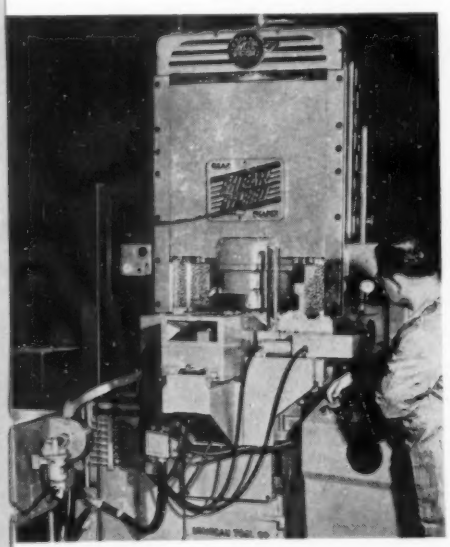
An automatic size control unit built into the machine and working in conjunction with the 3-way classifier control panel regulates total infeed of the radial cutting tools. It acts to increase or decrease total infeed by means of electrical impulses fed back through the 3-way gear classifier and control panel to the size controller as oversize or undersize gears are detected.

When tools are consistently oversize, the control panel shuts down the gear shaper for tool change.

The automatic magazine loader uses both an indexing rotary table and a shuttle movement. Finished parts are discharged into a chute. A magnetic chip separator removes chips automatically from the cleaning fluid in the gear washer.

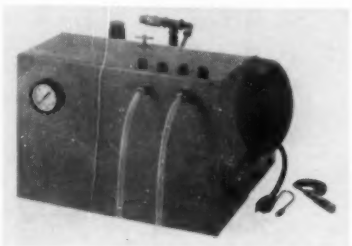
A clutch-brake unit installed in the drive system stops the work ram reciprocating crankshaft within 1 deg, assuring precise positioning of the work-holding fixture for the automatic loading operation.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. **T-1-1672**



Coolant System

Brier-Mist, developed to serve as a machine tool accessory, provides a controlled spray of coolant in exact amount at specific spot. Consistency of the spray does not vary regardless of "off-on" interruptions. As an economical feature, the mist provides a steady



flow of coolant for 8 hours on as little at 2 qts of coolant. It will not cloud or fog around the machine, and does not splash or throw off.

The heavy-duty water soluble coolant used with this equipment may be diluted in varying degrees most suitable to specific jobs. Units and nozzle attachments are available to meet each machine tool requirement. Equipment also is available for either manual or automatic operation.

Brierley D., Inc., Box 534, Oak Park, Ill. **T-1-1673**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Threading Tool

Quick-opening Quadra-type Beaver 78 threader, for use with any power drive, threads 1, 1¼, 1½ and 2 in. with a single set of full-width high-speed dies.

There is no lead screw, making operation with any power drive similar to that of a pipe machine. The user is able to set and reset dies instantly. Guide design of the tool gives instant, accurate alignment without clamping to the work.

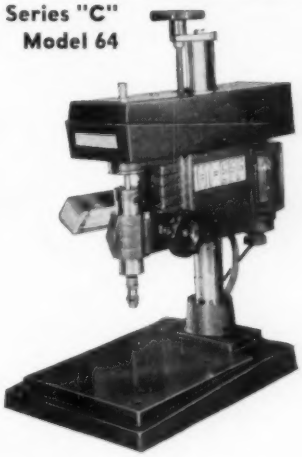
The Beaver 78 has a quick-opening die throw-out. When the throw-out is

New!

for sensitive precision drilling!

HI-EFF

Series "C" Model 64



Like its companion models in Series A and Series B, this new, low cost Series C, Model 64, is designed for sensitive, precision drilling on a production basis. Variable spindle speeds from 800 rpm to 10,000 rpm. Drills holes from .001" to .125" diameters. Compactly designed for maximum operator efficiency. Write for bulletin.

•

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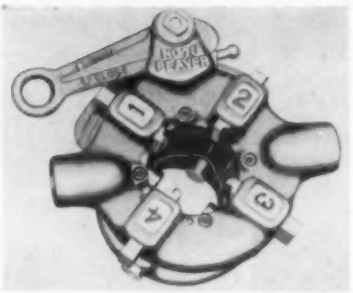
INDICATE A-1-167



opened, the dies retract, which avoids backing off over finished threads. When the handle is closed for the succeeding thread, the setting remains accurately in position.

The tool can be set in any position, open or closed, because the setting marks never vary. The high-speed dies are thick to absorb heat and stand up under constant operating pressure for longer die life and lower die cost.

Beaver Pipe Tools, Inc., Warren, Ohio. **T-1-1681**

From Airplane Wings to Armor Plate

No Matter What You Roll

you're sure to win "PRODUCTION OSCARS" with Kling PLATE ROLLS

You, too, can duplicate the performance accomplishments of plane and parts makers who are setting new time-and-money-saving records through their use of Kling Plate Bending Rolls, and the many other versatile Kling Metal Working Machines. Write today for Complete Line Bulletin 100.

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Westinghouse Electric Co.
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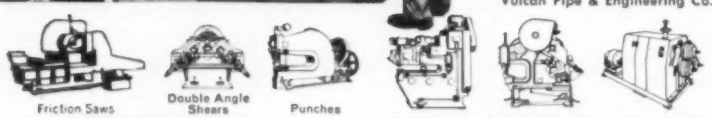
Pearl Harbor Naval Shipyard
Puget Sound Naval Shipyard
Vulcan Pipe & Engineering Co.



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Export Distributor: Simmons Machine Tool Corp.
50 East 42nd Street, New York 17, N. Y.

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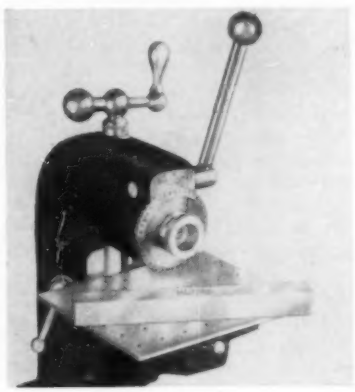
Indentor

This compact, bench type machine stamps identification data on metal plates, tools or parts quickly and with mechanical neatness. It obsoletes hand stamping and its disadvantages. Uniformity of spacing, alignment and depth are controlled to produce legible marking.

Operation is simple. The engraved dial makes the impression when actuated by the hand lever. Spacing between letters is automatic, and space between words is obtained by a half stroke of the operating lever.

The table is 8 by 10 in. and has 36 equally spaced ¼-in. tapped holes for mounting fixtures or gages. Machine



will accommodate parts from 1/32 to 3 in. thick, while throat permits stamping 4⅜ in. from top edge of part.

Standard dials are engraved with 40 characters including complete alphabet, period, slant, dash and numerals from 1 to 0. The unit is designed to take interchangeable dials with characters from 1/16 to 3/16 in.

Geo. T. Schmidt, Inc., 1810 Ravenswood Ave., Chicago 13, Ill. **T-1-1582**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hardfacing Paste

Hardfacing pastes that can be applied without special skill to impart a hard, abrasive-resistant deposit on any metal which has a melting point higher than that of the paste (1850 F), has been developed by Western Carbide Corp., subsidiary of Superweld Corp., 6840 Vineland, No. Hollywood, Calif.

Using gas flame, the substance, called Hi-C 60 Ruf-Nek, can be applied to metal of less than ¼-in. thickness; with proper induction heating, the paste

THE TOOL ENGINEER'S *Service Bureau*

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Literature Number	COMPANY	DESCRIPTION
A-1-198-1	Ace Drill Corp.	Carbide Drills—Information on ground-from-the-solid drills and hardened H. S. S. drill blanks. (Page 198)
A-1-16	The American Tool Works Co.	Radial Drill—Bulletin No. 327 contains data on the American Hole Wizard Radial. (Page 16)
A-1-163	Armstrong Bros. Tool Co.	Tool Holders—Catalog on production-increasing and cost-cutting tool. (Page 163)
A-1-261	The Aro Equipment Corp.	Multiple Drilling—Assistance in planning multiple Par-A-Matic installations is contained in bulletin 5546-T. (Page 261)
A-1-243	W. F. & John Barnes Co.	Special Machines—Booklet describes the scope of Barnes' machine tool building service. (Pages 242-243)
A-1-63	Behr-Manning, Division of Norton Co.	Abrasive Belts—Detailed data on coated abrasive grinding and polishing techniques. (Page 63)
A-1-263	The Bellows Co.	Air Motors—Illustrated booklet outlining advantages of air motor installations. (Page 263)
A-1-213	The Bullard Co.	Machine Attachments—Catalog contains production facts on the Bullard Spacer Table. (Page 213)
A-1-276-1	Cerro de Pasco Corp.	Matrix Metal—Data on anchoring bearings, bushings and non-moving parts in machine building. (Page 276)
A-1-27	The Cincinnati Milling Machine Co.	Hydrospinning—Bulletin M-1873-1 contains machine specifications and a description of the Hydrospinning process. (Page 27)
A-1-35	The Cincinnati Shaper Co.	Shears—Data on Cincinnati shears contained in catalog S-7. (Pages 34-35)
A-1-70	Clearing Machine Corp.	Presses—Descriptive information on O.B.I. Presses. (Page 70)
A-1-286-2	Concentric Tool Corp.	Live Centers—Production data on spring-loaded live centers. (Page 286)
A-1-39	Crane Packing Co.	Lapping Service—Information on producing precision flatness on machine parts. (Page 39)
A-1-192	Detroit Power Screwdriver Co.	Special Machinery—Information on power screwdrivers and selective feeders available in detailed catalog. (Page 192)
A-1-232-2	Detroit Stamping Co.	Toggle Clamps—Literature on new DESTACO Titan Models 557 and 558. (Page 232)
A-1-257	Electro Refractories & Abrasives Corp.	Grinding Wheels—Information on grinding wheels contained in Bulletin T-855. (Page 257)
A-1-228	Erickson Tool Co.	Pneumatic Bar Feed—Circular K-2 contains information on Erickson Pneumatic Bar Feed. (Page 228)
A-1-31	Frauenthal Division, The Kaydon Eng. Corp.	Turning Machines—Information on precision turning and grinding contained in bulletin No. 301. (Pages 30-31)
A-1-172	The Gaertner Scientific Corp.	Microscopes—Bulletin No. 147-50 contains uses of Toolmakers' Microscope. (Page 172)
A-1-40	Greenlee Bros. & Co.	Automatics—Bulletin No. A-405 contains information on Greenlee automatic bar machines. (Page 40)
A-1-222-2	Kaufman Mfg. Co.	Tapping Machines—Catalog 754 and 1153 mailed on request. (Page 222)
A-1-68	Keller Tool Division, Gardner-Denver Corp.	Portable Air Drill—Information on all-new Keller Air Drills contained in Bulletin 11A. (Page 68)
A-1-58	Kennametal, Inc.	Die Steels—Copy of new die grade selection chart and information on die steels contained in Booklet B-100. (Page 58)
A-1-168	Kling Bros. Eng. Works	Plate Benders—Bulletin 100 illustrates and describes complete Kling line of metal working machines. (Page 168)
A-1-240	Lindberg Engineering Co.	Induction Heating—Bulletin 1441 contains information on the Lindberg line of special machines. (Page 240)
A-1-200	Linde Air Products Co., Division Union Carbide & Carbon Corp.	Flame-Plating—Bulletin contains information on flame-plating. (Page 200)
A-1-289	Logansport Machine Co., Inc.	Hydraulic Circuits—Free booklet on "Circuit Rider" available. (Page 289)
A-1-274	Madison Mfg. Co.	Tools—Literature available on adjustable boring, trepanning tools, precision drills and adjustable boregages. (Page 274)
A-1-166	Metal Carbides Corp.	Carbide Tools—84-page catalog No. 56-G gives details. (Page 166)

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A-1-232-3	W. F. Meyers Co., Inc.	**Carbide Inserted Drill Bushings**—Information and prices for Meyco Drill Bushings are contained in catalog No. 42. (Page 232)
A-1-15	Michigan Tool Co.	**Special Machines**—Informatiton on forming splines and similar toothed parts given in Bulletin RF-55. (Page 15)
A-1-220	Micromatic Hone Corp.	**Honing**—Microhoning applications contained in bulletin "Cross-Hatch" Vol. 7, No. 4. (Page 220)
A-1-59	The National Acme Co.	**Automatics**—Catalogs CM-51, M-450-A, MC-53, M-50-A give information on chucking and bar automatics. (Page 59)
A-1-259	National Broach & Machine Co.	**Gear Shaving**—The Red Ring Model GCI described in Bulletin S49-4. (Page 259)
A-1-28	Nelco Tool Co., Inc.	**Cutters**—Over 850 standard cost cutting, time cutting cutters are described in new catalog. (Page 28)
A-1-41	The O.K. Tool Co., Inc.	**Milling Cutters**—Dual Adjustment milling cutters are described in Catalog 13. (Page 41)
A-1-232-1	Petz-Emery, Inc.	**Dial Indicators**—Em-re Precision Indicators are described in Bulletin 455-D. Page 232)
A-1-252	Pines Engineering Co., Inc.	**Benders**—"Pines News", a bi-monthly mailing piece, gives facts on new cost-cutting bending operations. (Page 252)
A-1-254-3	J. A. Richards Co.	**Benders**—Illustrated folder TE-5 describes the Multiform Big Brother Bender. (Page 254)
A-1-193	Seibert & Son, Inc.	**Drill Spindles**—Follo 1-50 illustrates and describes the complete line of Seibert multiple-drill spindles. (Page 193)
A-1-256	Seneca Falls Machine Co.	**Centering Machine**—Bulletin CS-54 tells the story on Model CS automatic centering machine. (Page 256)
A-1-227	Simonds Abrasive Co.	**Bonded Abrasive Wheel**—Bulletin ESA-244 gives information on this new Simex Red Wheel. (Page 227)
A-1-165	The S-P Mfg. Corp.	**Power Chucks**—Catalog 105 describes the advantages of S-P Power Chucks. (Page 165)
A-1-178-2	Standard Parts Co.	**Jig and Fixure Components**—Economies and other advantages of Standard components are discussed in 66-page catalog. (Page 178)
A-1-266	D. A. Stuart Oil Co., Ltd.	**Cutting Fluid**—Stuart's precision grinding oil bulletin available upon request. (Page 266)
A-1-244-2	P. A. Sturtevant Co.	**Torque Wrenches**—Data concerning torque wrenches are contained in catalog. (Page 244)
A-1-67	Sundstrand Machine Tool Co.	**Special Machines**—Numerous automatic operations are described in Bulletin No. 763. (Pages 66-67)
A-1-49	Superior Steel Products Corp.	**Die Set**—Write for 24-page catalog on Superior Die Sets and Supplies. (Page 49)
A-1-167	Taylor Dynamometer and Machine Co.	**Drilling Machines**—for both toolrom and production are described in Bulletin 181. (Page 167)
A-1-293	United States Rubber Co.	**Machine Belts**—Descriptive literature on U. S. PowerGrip Timing Belts. (Page 293)
A-1-12	U. S. Tool Co., Inc.	**Special Machines**—Bulletin 15-T contains specifications for U. S. Multi-Slide Machines. (Page 12)
A-1-237	The Van Keuren Co.	**Lapping Service**—New 258-page catalog and handbook No. 36 contains valuable technical and engineering information on measuring problems and methods. (Page 237)
A-1-283	Wales-Strippit Corp.	**Special Machines**—Bulletin No. 12 contains pictures and examples of Wales-Strippit's in use. (Page 283)
A-1-161	Wilson Mechanical Instrument Division, American Chain & Cable Co.	**Hardness Testers**—Booklet AH-114 available on Wilson Tukon Micro Hardness Testers. (Page 161)
A-1-180	Wisconsin Drill Head Co.	**Tapping Attachments**—Bulletin describes single or multiple precision tapping attachments for special machines. (Page 180)

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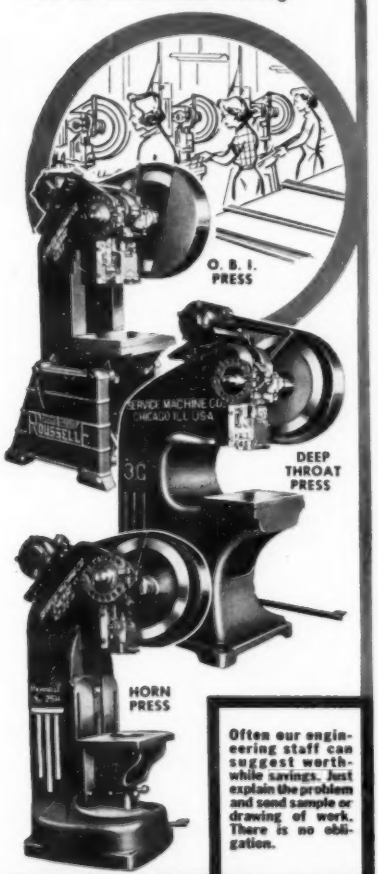

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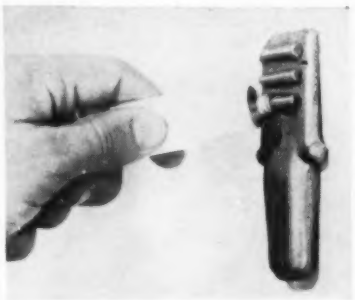
INDICATE A-1-171-1

will hardface metal of any thickness.

Surfaces treated with this hardfacing paste can withstand high temperature applications that normally would soften or destroy the wearing properties of heat-treated surfaces.

A permanent suspension of powdered hardfacing alloy in a water base



solution, Hi-C 60 can be applied by spatula, brush, or by extrusion from a tube. The paste is deposited in a layer up to $\frac{3}{8}$ in. on the surface to be hardfaced. Heating the base metal by flame, or high-frequency induction up to the fusion point of the paste, causes the paste to fuse and bond to the base metal. The hardness of the treated surface ranges from 55 to 61 R_c. **T-1-1711**

Cutting Oil

Extreme pressure characteristics, which provide unusual operating properties, are available through a recently developed transparent cutting oil. It can be used in practically all cutting, broaching, threading and similar operations, whether automatic or manual, which require such pressure properties.

The substance, called Transultex Cutting Oil B HD, offers cost-saving benefits of heavy-duty black sulfurized cutting oils, in addition to production advantages of transparent materials.

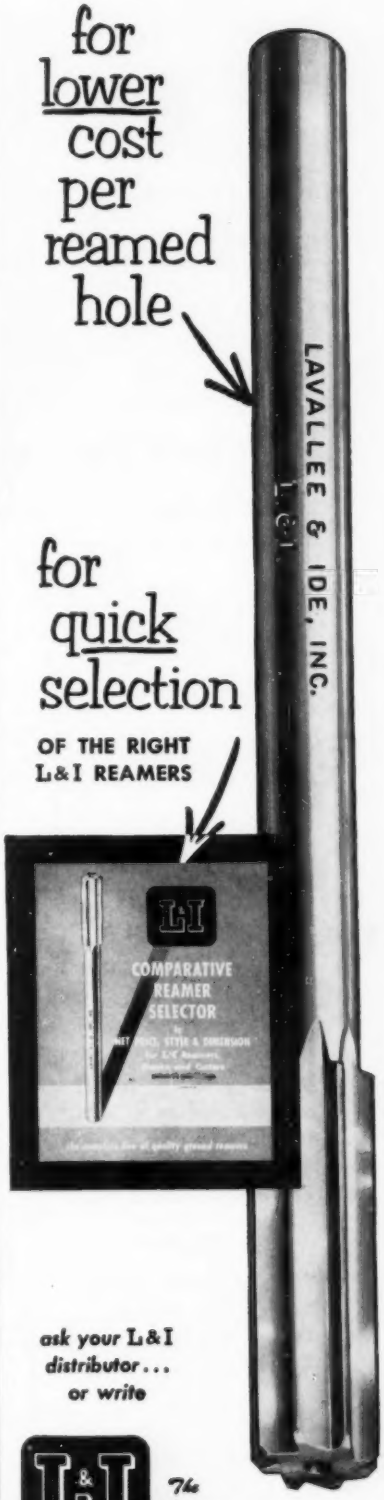
While providing heavy-duty protection in precision work, transparent quality of the oil enables the operator to see both the tool and the work surface during an operation. Visual access during production provides benefits which are reflected in lower unit cost. The transparent product is easy to remove from a finished piece.

The Texas Co., 135 E. 42nd St., New York 17, N. Y. **T-1-1712**

Collet Closer

An automatic collet closer provides hollow spindle lathes and other rotating hollow spindle machines with automatic or semiautomatic stock holding. Collets

for lower cost per reamed hole



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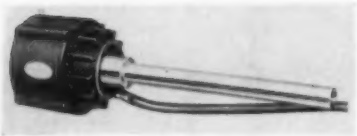
INDICATE A-1-171-2



may be opened and closed instantly without stopping the machine. Holding pressures do not vary from piece to piece, and variations in stock size do not affect the action of this Model BCC-60.

Simple in construction, the unit consists basically of a hollow draw bar mounted through the center of an air cylinder. The machine collet, fastened to the end of the draw bar, is opened and closed by operating the nonrotating type air cylinder which exerts a closing pressure equal to 25 times the air pressure applied. The draw bar permits through-feeding of stock up to a maximum of 1 in. in diameter.

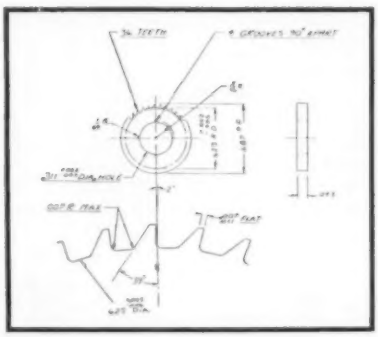
The BCC-60, which mounts directly to the machine headstock, may be push-button controlled by the operator or interlocked with the machine cycle for fully automatic operation.

The Bellows Co., Akron 9, Ohio.

T-1-1721

Gaertner OPTICAL INSTRUMENTATION

to measure and check parts like this



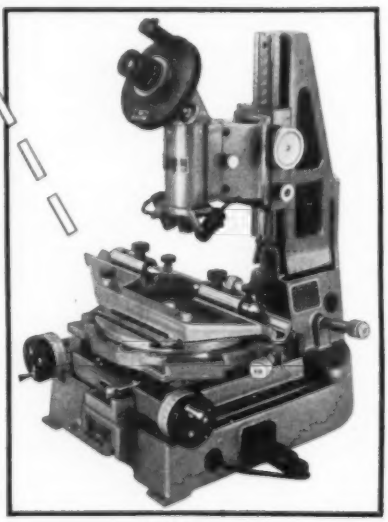
Use the Gaertner Toolmakers' Microscope

FEATURING

Range	2" x 4"
Reading to	.0001"
Stage Rotation	360°
Reading to	1 minute
Magnification	30X
Protractor Ocular	

ACCESSORIES

Templet Ocular Head
Radius and Thread Templets
Camera Attachment



M2001ARS

Write for Bulletin No. 147-50

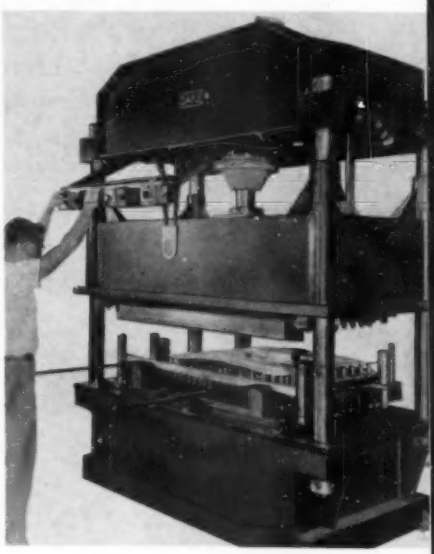
The Gaertner Scientific Corporation
1241 WRIGHTWOOD AVENUE *CHICAGO 14, ILLINOIS*

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-1-172

Press for Plastics

A line of hydraulic presses for trimming and piercing parts made from vacuum-formed plastic is designed to enable operating speeds to match those of the forming equipment.

These Dake plastic presses feature fast ram approach for time-saving



closure and return of the movable platen, adjustable stroke control for automatic slowdown before work is contacted and accurate pressure for maximum job flexibility. All-steel construction and guided platens assure the rigidity and alignment necessary for accurate work.

Five standard models are available in capacities from 75 to 300 tons, with platens ranging from 40 by 50 in. to 60 by 80 in., and open heights from 22 to 40 in.

Dake Corp., Grand Haven, Mich.

T-1-1722

Automatic Loader for Cylindrical Grinders

Automatic loading of workpieces between centers and removal of the pieces when ground is done with a device developed by Norton Co., Worcester 6, Mass. The loading attachment can be adapted to a wide variety of small parts that can be rolled by gravity on inclined rails, and permits an operator to attend a battery of machines.

It is of the turret type, supporting the work near both ends. A number of workpieces may be placed on the loading rails by the operator or fed to

the loader from a suitably placed conveyor. Latches placed along the loading rails separate the parts and operate to release a single piece at a time to the turret, which is carried on a swinging arm. Motion of the arm is controlled by a small hydraulic cylinder and piston operated by a valve in the operating cycle of the machine. When a workpiece is received in the turret, the arm swings the turret to locate the piece in line with the work centers.

After the piece has been ground, the turret arm swings upward and a latch indexes the turret so that the piece rolls onto the inclined unloading rails. Latches along the unloading rails automatically accept and release one piece at a time, keeping the pieces separated, and preventing finished surfaces from being marred. **T-1-1731**

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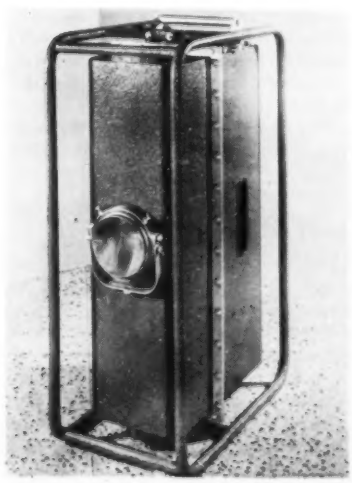
Weld Inspector

A new spot-check X-ray unit permits wider use of radiography in weld inspection.

Basic design feature of the tool is the extremely low weight-to-power ratio: the X-ray head weighs only 46 lb and provides a power penetration of 140 kvp. The entire unit, comprised of X-ray head and control panel, fits inside a trunk 32 by 16 by 13½ in.

The unit, named the Baltospot, provides spot-check radiographs up to a capacity of 1½-in. steel or the equivalent.

Two other X-ray units also are being introduced. The Baltograph 180, rated at 180 kvp, is an end-grounded unit with the X-ray source at one end of the



in DRILLS for FERROUS METALS

To boost your production—have fewer resharpenings—reduce drill breakage—lower costs—Whitman & Barnes manufactures a complete line of drills for ferrous metals. Each drill type is specifically designed to provide highest efficiency when drilling individual metals.

Over 100 years of research, experience and engineering have enabled W & B to provide better drill designs—"There's A Big Difference"—that difference means faster, better and more economical drilling for you. Call your W & B distributor for quality service and the best in drills.

Whitman & Barnes manufactures complete lines of standard drills, reamers, carbide tools, counterbores, countersinks and tool bits, also special tools to your specifications.

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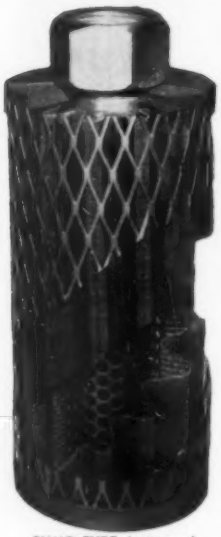
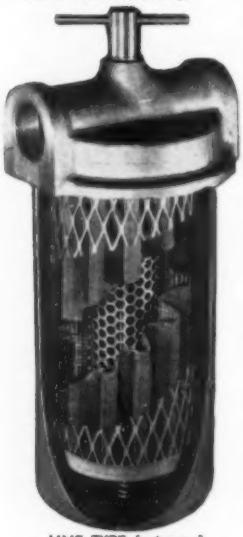
Here's What Users Have to Say About

MARVEL Synclinal FILTERS



SUMP TYPE (cutaway)



LINE TYPE (cutaway)

U. S. STEEL CO., Irvin Works Three-Stand Cold Reduction Mill—
"Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates Coil Cradle as well as other hydraulic machines."

JONES & LAUGHLIN STEEL CORP., Aliquippa Works—
"Marvel Synclinal Filters proved their effectiveness when one of the motors on the hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all metal particles had been filtered out by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production could be costly in an operation of this size."

MANY OTHERS REPORTING SIMILAR RESULTS ARE NOW SPECIFYING MARVEL SYNCLINAL FILTERS ON ALL NEW HYDRAULIC EQUIPMENT — AND STANDARDIZING WITH MARVEL SYNCLINAL FILTERS ON ALL EXISTING EQUIPMENT

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FILTERS FOR ALL TYPES OF FIRE-RESISTANT FLUIDS
Marvel's most recent development is a filter for the efficient filtration of all types of fire-resistant fluids.

WATER FILTERS
Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced, synclinal design.

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Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

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7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: Juniper 8-6023

Catalogs containing complete data available on request

Without obligation, please send me complete data on Marvel Synclinal Filters, as follows:—
☐ Catalog #106—For Hydraulic Oils, Coolants and Lubricants
☐ Catalog #300—For WATER
☐ Data on filters for Fire-resistant hydraulic fluids.

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Company .....
Address .....
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TE-1

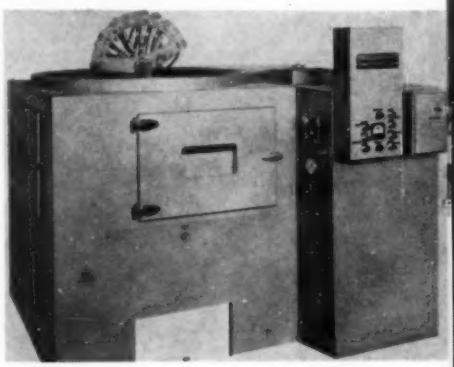
head that enables the operator to reach otherwise inaccessible locations.

The Baltograph 260, rated at 260 kvp, provides the high power of penetration required in checking thick, high-density metals.

Balteau Electric Corp., Stamford, Conn. **T-1-1741**

Wet Blast Unit

An automatic pressure type wet blast unit for finishing the interiors of large cylindrical sheet metal parts has been designed primarily for removing selenium deposits from the interior areas of "half hemispheres" approximately 30 in. in diameter. Formerly, a nitric acid dip was employed which was discarded in favor of wet blasting because of the inefficiency of the process and the inability to reclaim the selenium metal. Wet blasting removes excess selenium and imparts a clean metal surface.



In operation, the part is lowered on a circular bearing around the blast gun fixture. The bearing is rotated by a variable-speed drive and the gun fixture is moved back and forth by means of an air-hydraulic cylinder. At the completion of the five-minute cleaning cycle, work rotation and blasting automatically cease and the part is raised from the machine.

The Cro-plate Co., Inc., Hartford, Conn. **T-1-1742**

Oiler-Straightener

The low-cost Jaco light-duty oiler-straightener cleans, straightens and lubricates stock up to 3-in. wide, in one operation. It is designed to remove coil set for smooth feeding, but will not straighten or flatten badly kinked material.

Neoprene rubber wipers clean the stock as it enters the case where five rollers induce a double reverse bend as

the material is pulled through. Three lower rollers pick up oil from the bottom of the case and apply it to the stock. Excess oil is removed by felt pads, leaving an even film on both surfaces of the stock. Oil is stored in an unbreakable polyethylene one-pint bottle-reservoir.

Jaco Devices, Inc., 101 High St., Hingham, Mass. **T-1-1751**

Automatic Testing Machine

An automatically controlled physical testing machine, the Super L, incorporates an automatic typewriter for printing test results.

Designed for pushbutton simplicity, it requires only insertion of the specimen to be tested to start operation. Everything else is automatic. If desired, however, the testing machine can be operated manually. In automatic operation, all phases of production tensile tests are controlled by a built-in programmer. Preset controls minimize the time required to conduct successive tests, and also assure uniformity of testing procedure for any number of tests with similar specimens. A separate electric typewriter automatically prints the yield strength for the selected percentage of offset, plus an identifying test number as each specimen is tested. With this unit, yield strength or other test data is determined immediately without interpolation of a stress-strain curve.

The program controller used with the Super L permits tensile tests to be conducted at the highest practical speed in minimum time without the danger of overshooting the yield point. The control points can be determined by means of an initial test or from a written record of previous settings for the same material. Once set, the same testing procedure is followed exactly until the controls are changed by the operator.

Production tensile testing is but one of six types of tests for which program controllers are currently available. Others include production proof testing, yield strength by the extension under load method, stress cycling and cross-head cycling.

The automatic printer is equally adaptable to hydraulic Super L and electromechanical Electromatic types of testing machines.

Tinius Olsen Testing Machine Co., 5069 Easton Rd., Willow Grove, Pa. **T-1-1752**

Drills

Stationary 21-in. head floor-drills feature built-in elements conveniently located for operator ease. The drills are shipped complete with motor and controls and are ready to operate as soon as power leads are connected to the factory installed electrical controls built into the head.

Power feed for the drills is standard equipment, as is the sensitive hand lever and handwheel feed. A simple

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Ring Standardized Punches and Dies offer cost saving dependable performance for all of your perforating problems.

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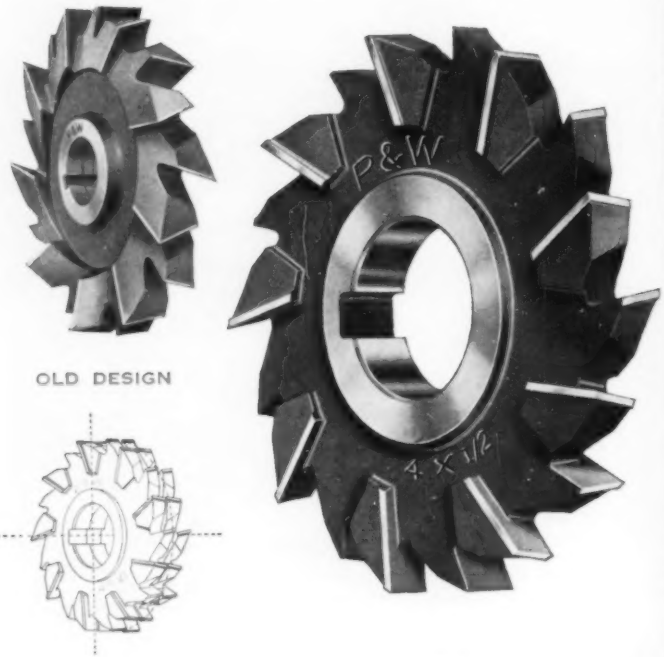

OLD DESIGN

MANY COMBINATIONS POSSIBLE WITH NEW P&W DESIGN

All P&W Staggered Tooth Side Milling Cutters of the same diameter have the same number of teeth and all keyways are located alike. By simply grinding the mating hub faces, 2 or more cutters (of the same or various widths) can be interlocked side by side to produce a very wide choice and range of widths. The results are: greatly reduced inventories, fewer special orders, fewer delays, greater convenience and lower tool costs. (Notice too the new raised lands on all cutting edges to permit faster and more economical grinding.)

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16 Charter Oak Boulevard, West Hartford 1, Connecticut
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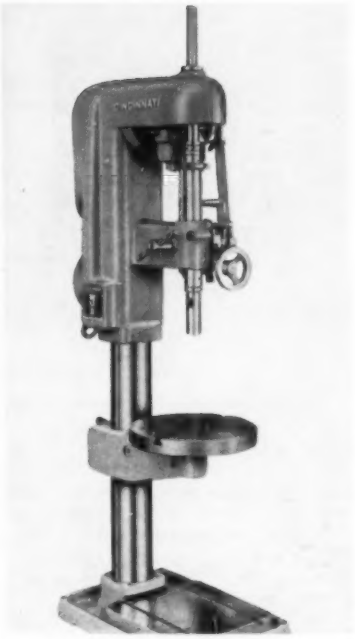
MACHINE TOOLS • GAGES • CUTTING TOOLS



selector is used to obtain any of four rates of feed. A depth gage, incorporating a positive stop, is provided to disengage feed automatically.

The No. 4 Morse taper spindle has eight spindle speeds ranging from 23 to 400 rpm. No wrenches are required to change spindle speeds, and both hands are free to shift the V-belt to the proper position. A full belt guard is standard equipment.

The drills are rated at 1½ in. in cast iron with a 1-hp, 1800 rpm motor.

Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio. **T-1-1761**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Industrial Truck

The new KGA51 series of Yale industrial lift trucks is equipped with torque transmission which provides fully automatic gear shifting, permitting faster, smoother materials handling with greater operator comfort and safety.

The trucks in this series, built in capacities from 3000 to 8000 lb are available powered by gas, diesel or LPG.

The torque transmission is designed to provide an automatic response for every power demand in industrial lift truck operation. Since torque multiplies in infinitely varying ratios the transmission automatically puts the truck in the

most suitable ratio relative to load and speed.

Transmission overheating is impossible because of a large oil reservoir, and finned oil lines running through an auxiliary radiator.

Oil cooled, oversize, duplex type, hydraulically operated clutches have been utilized to accomplish directional change. All transmission gears are in constant mesh with wide face helical gears being used for greater strength, quietness and smoother operation. Oil pressure to fit the transmission requirements is provided by an externally mounted pump.

Every truck in the series is equipped with inching control for smoother and more accurate maneuvering. Dual brake pedals permit operation of the inching control with the left foot while the right depresses the accelerator to provide faster lift or attachment action.

Yale Materials Handling Div., The Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa.

T-1-1771

Double Row Ball Bearings

A type of double row unground ball bearing with high performance and controlled tolerances are available for use in applications in which parts of the end product are used to form the inner and outer races. These bearing,

called Versa-Twin, are made to specific product requirements; applications must be engineered into the redesign of an existing product or into the design of a new product.

The inner race can be the customer's product shaft, an adaptation of it, or a shaft fitted to a part by means of screw, snap ring, rivet, spotweld or knurled press. The outer race can also be a functional component of the product.

Use of the development may be advantageous, especially where expensive

When it comes to SOLID CARBIDE PRATT & WHITNEY offers YOU the RIGHT TOOL... for Your Job

Lasting up to 200 times longer than high speed steel and able to lower production costs tremendously, carbide *IS* the tool of today and tomorrow!

But — you *can not* simply remove the high speed tools and replace with carbide. Additional power is required to drive carbide efficiently; speed, feed and chip load must be carefully correlated with type and depth of cut, finish required and many other factors. The correct grade of carbide for *each* application must be determined.

Now — traditional Pratt & Whitney cutting tool know-how and experience, supplemented by a 10-year program of special research and development in carbides, bring you this assurance: the *RIGHT* carbide tools for your specific jobs. Send us your work blueprints and acquaint us with type of machines involved. We will be glad to submit our job recommendations.

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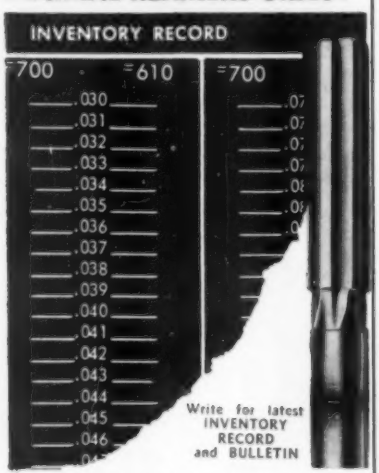

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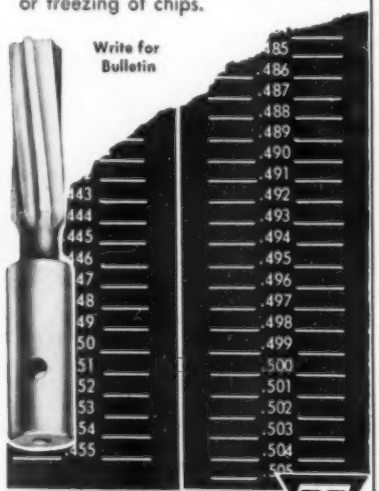

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INDICATE A-1-178-1

precision bearings are used, or where space limitations have previously necessitated use of plastic or powdered metal sleeve bearings. The bearings offer stability and are double-acting, because they can carry both the radial load and the thrust load in both directions, locking the moving parts into the desired axial position. Designed for space and weight saving, they offer ball bearing performance with a specific friction factor of 0.0015. Speed and load are basically related to material and dimensions. Unhardened bearings are designed for lower speeds and loads; if case hardened, they will withstand higher speeds and loads.

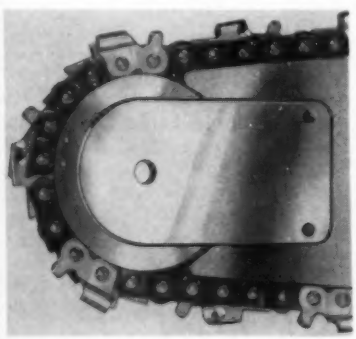
These components can be made of practically any material or combination of materials. Although there are no definite limits on size, to date they have been made in sizes ranging from 3/16 in. in length to approximately 1½ in. OD.

Versa-Twin Div., Hartford Steel Ball Co., 12 Jefferson Ave., West Hartford 6, Conn. **T-1-1781**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Chain Saw Guide

A fundamental chain saw improvement is available with the advent of a new snap-on roller bearing nose guide for use on any chain saw. By free-



wheeling the chain, it produces up to 20 percent more usable cutting horsepower.

The roller bearing, which simply snaps on, minimizes friction between fast-cutting chain and guide bar, resulting in faster cutting and less wear.

The bearing is pressed into the slot that is machined into the nose of the guide bar, and can be quickly and easily removed.

A template for machining the bar is supplied with each snap-on roller bearing. The bearing is available in 2½

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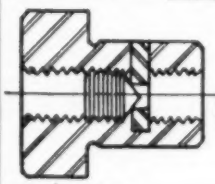
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DOUBLE CAM LEVERS

FLAT NOSE HEEL CLAMPS
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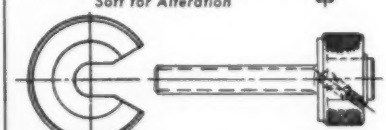
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INDICATE A-1-178-2

and 3½ in. diameter sizes for use on bars up to 54 in. The bearing will also be available to fit bars of any thickness.

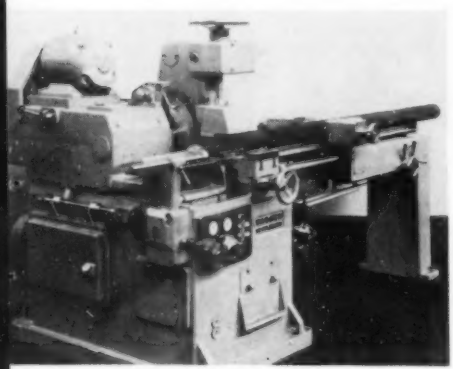
Bars equipped with the roller bearing also will be supplied in sizes from 15 to 54 in.

Mall Tool Co., 7725 S. Chicago Ave., Chicago 19, Ill. **T-1-1791**

Cold-Sawing Unit

A semiautomatic, single-lever control cold-sawing machine, Model WK-360, is being manufactured by the Gustave Wagner Machine Tool Works of Reutlingen, Germany.

The same basic machine is also offered as model WKA-360 full automatic, single-lever control; WKM-360 semiautomatic high-speed for sawing the common nonferrous metals; and as WKMA-360 full automatic high-speed for common nonferrous metals.



The unit has a capacity of 4⅜ in. for rounds, and for other shapes in proportion.

Klingelhofer Machine Tool Co., Kenilworth, N. J. **T-1-1792**

Tube Piercing Units

A line of double-acting tube piercing units for use in press brakes and punch presses has many applications in fabricating various products where clean, accurately located single or multiple holes are required in tubular parts.

They are specially designed to avoid many troublesome setup and maintenance problems encountered in short and long-run punching of tubing.

Simply by applying a straight edge to the surfaces of the adapter plates which fit over the tubing in the punch gives alignment between upper and lower sections. There is no die in the unit to shear the punches through misalignment.

These tube piercing units can be set up on flat plates for mounting to bolster and ram plates of punch presses. Keyed plates for mounting individually in press brakes can also be furnished. For a series of holes, templates for mounting the desired number of units in the required positions can be supplied.

Capacities of standard Wales tube piercing units are ½ to 1 in. OD tube; maximum punch diameter, 0.312 in.; maximum wall thickness of tubing, 0.093 in.

Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y. **T-1-1793**

Finish Comparator

Surface finishes may be both specified and inspected for roughness by means of this pocket-size scale. It contains samples of 22 different surfaces ranging from lapped to milled finishes. The specific surface which is to be matched is simply placed next to the workpiece for rapid, easy comparison both by eye and fingernail feel.

In addition to its use for inspection, the comparator permits preselecting desired surface finish, enabling preselection also of the quickest and most

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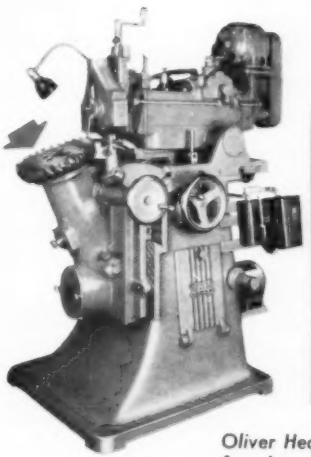
Fully Automatic . . .
Hydraulically Operated . . .

THE Oliver FACE MILL GRINDER



- EXCLUSIVE! THE ONLY MACHINE THAT AUTOMATICALLY GRINDS THE FACE, CORNER RADIUS OR CORNER ANGLE, LEAD ANGLE, AND ALL NECESSARY CLEARANCES SIMULTANEOUSLY.
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- THREE STANDARD MACHINES—CAPACITIES: 6" to 16" DIAMETERS . . . 8" TO 18" DIAMETERS . . .10" TO 21" DIAMETERS.

Oliver Heavy-Duty Hand Operated Face Mill Grinder for close pitch cutters and Oliver Arc Radius Cutter Grinders are also supplied. Write for complete details.

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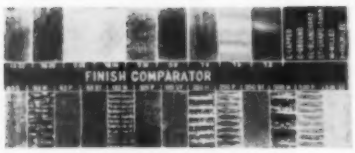
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-179



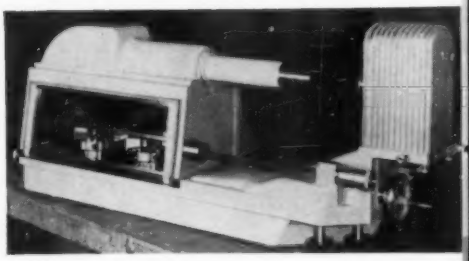
economical machining method. The tool, made of rust-resistant nickel, comes complete with leather case.

Montgomery & Co., Inc., No. 1 Tichenor Lane, Newark 5 N. J. **T-1-1801**

Gage Block Measure

An interferometer for absolute measurement of gage blocks to an accuracy of one millionth of an inch, employs light waves with a special design proven through experience at the National Physical Laboratory where the instrument was developed.

Simple in basic setup, this N.P.L.-Hilger interferometer can accommodate 36 gage blocks at one time in a temperature insulated case. Measurement of



length, flatness and parallelism of faces can be made in a choice of the best radiations from varying light sources. Because the gages are measured in the condition in which they are used, there is no need for special support or compensating calculations.

The instrument can handle gage blocks of all common sections and is particularly suited for their production, inspection and calibration.

Engis Equipment Co., sole distributors for the U.S., 431 S. Dearborn St., Chicago 5, Ill. **T-1-1812**

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for **Single or Multiple PRECISION TAPPING** *on your* **SPECIAL MACHINES**

WISCONSIN Model TU-415 Automatic Lead Screw Tapping Unit.

The WISCONSIN Model TU-415 Automatic Lead Screw Tapping Unit is a completely self-contained assembly designed especially for *precision work* on your special machines.

It may be mounted in any position and is permanently sealed against coolant entry.

Safety Features provide positive protection against spindle over-travel and tap end-thrust.

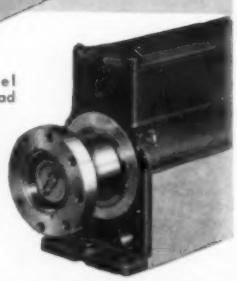
Setting up and Re-setting is done easily and quickly.

Versatility is assured by ready changeability of spindle speed, spindle travel and thread pitch.

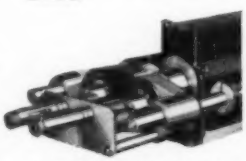
Controls are built in. A reversing motor controller and initiating switch or push button operate the unit. No relays are required.

Precision Construction permits precision tapping on a production basis. Simplicity of design assures ease of maintenance, accessibility of all parts.

Write for Illustrated Bulletin



For Single Spindle Tapping, the TU-415 is furnished without quill flange and with ASA 1" bore, adjustable adapter spindle.



For Multiple Spindle Tapping, standard equipment includes flanged quill and slotted spindles for close-coupled multiple spindle tapping heads.

WISCONSIN DRILL HEAD CO.

4897 N. 124th STREET • BUTLER, WISCONSIN

A8425-1P

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-180

Metal Adhesive

A high-strength, one-part-paste, thixotropic, epoxy-based adhesive, called Bondmaster M620, successfully bonds metals to metals or to rigid plastics.

This single-component formulation,

which does not require mixing of a separate resin and hardener, permits economical use of adhesive bonding in the mass-production joining of rigid materials. It may be used directly from the shipping container by personnel without specialized training.

A wide choice of practical curing cycles is available, ranging from approximately 7 minutes at 535 F to about

1½ hours at 350 F. Lower curing temperatures, down to 260 F, may also be used where longer curing time can be tolerated.

Based upon Ciba "Araldite" AN-100, the product gives comparable physical results.

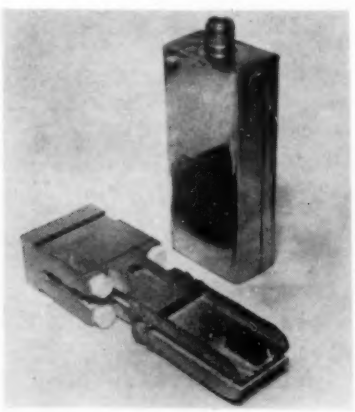
The thixotropic nature of the material results in absence of drip or run either before or during cure. However, it has a smooth, buttery consistency and can be easily spread with brush or spatula to the exact thickness dictated by the specific end use. Whatever the thickness of the glue line laid down by the user before curing, it remains the same after curing. Because of absence of flow during the curing cycle, the adhesive may be used to join supported components at any relative angle. After cure, the components will retain their relative positions without support.

Rubber & Asbestos Corp., Dept. P, 225 Belleville Ave., Bloomfield, N. J.
T-1-1811

Contact Cell

A low-cost weight sensitive cell which activates at any one predetermined load point is resistant to extreme overload, and resists corrosion or weather effects.

This small contact cell incorporates a subminiature limit switch built to



withstand over 1,000,000 cycles of operation. Fitted to a deflecting member, the entire assembly is then hermetically sealed in a stainless steel case. No special instrumentation or readout equipment is required. The cell operates at 1 amp, 125 volts a-c, and is currently available in ranges of 500 through 10,000 lb.

Total travel of the cell at the load point is approximately 0.005 in; a steel stop in the cell prevents damage to the switch even under extreme overload.

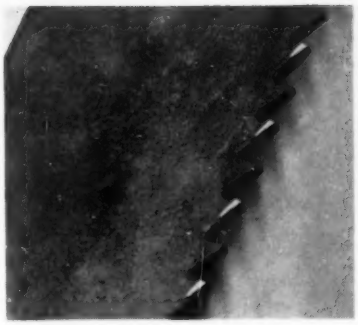
Practical applications utilizing the device's features include: an actuator for treadles where low loads must be ineffectual; a safety indicator on crane hooks, drag lines, etc.; or a tripping device for automatic operation at given load points.

Control Cells Corp., Box 337, Boulder, Colo. **T-1-1812**

Hacksaw Blades

A development in power hacksaw blades, in which the teeth are chamfered, is calculated to improve hacksaw metal-cutting.

The new Atkins "Chamfer-Tooth" blade is considered a precision cutting tool. Among the advantages afforded



by the tool are the straight cuts possible. Pieces cut by the tool require no second, or milling operations. Longer life is assured because the teeth do not dull or round off as quickly as former

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Equally important, plan to attend the 5-day, all-industry conference covering the latest developments in manufacturing techniques and equipment.
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types, giving more clean sharp cuts per blade. There is less breakage because the Chamfer-Tooth blade will take a greater load, reducing breakage and giving faster cuts. Smoother cuts result from the chamfered teeth actually milling as they cut. Results are uniform curled chips and no dust. The last cut is made almost as quickly as the first, demonstrating the maintenance of time per cut.

The Atkins Chamfer-Tooth blade is available in 3, 4 and 6-tooth sizes.

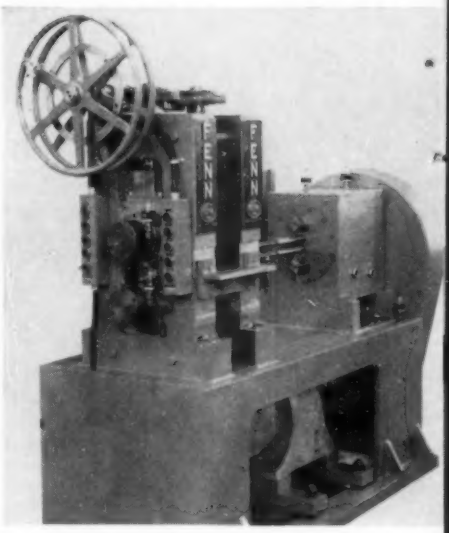
Atkins Saw Div., Borg-Warner Corp., Indianapolis, Ind. **T-1-1821**

Rolling Mill

A combination rolling mill, designed for laboratory use, features a drive which permits 2-high operation, 4-high operation with backup rolls driven and 4-high operation with work rolls driven.

Drive couplings can be changed in only a few minutes in order to shift from backup to work-roll drive. To shift from 4-high to 2-high operation, the work rolls and their bearings are easily and quickly removed.

By varying the drive and the number of rolls used, this mill operates efficiently over a complete range of reductions, from breakdown rolling to thin gages. As a 2-high mill, breakdown passes can be taken. As a 4-high with backup rolls driven, intermediate passes can be taken on wide stock. As a 4-high with work rolls driven, light passes on all work and substantial passes on narrow work can be taken.



Fenn Mfg. Co., Newington, Conn. **T-1-1822**

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Eclipse Radial Drive High Speed Steel Cutter bores 5 diameters in steel part.

Special Cutter forms ball seat in road building machinery unit.

Tungsten Carbide Tipped Cutter precision bores three diameters in aluminum gear case.

Radial Drive Tungsten Carbide Tipped Cutter bores gear pocket in oil pump.

Multi-diameter cutter with Tungsten Carbide Tipped inserted blades for boring, counterboring and chamfering.

Since 1913—through two wars and during the peace years—Eclipse has met the exacting and changing demands of industry for special purpose end cutting tools. What better test? What better recommendation? Our large modern plant can serve you, too. Send your problem to us, today!

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Electrical Foot Switch

A circumference actuated electrical switch that makes positive contact when pushed on top, or anywhere on its circumference, has been developed for use

with production machinery requiring fast, safe switching. Although normally used as a foot switch, it may be activated with hand, elbow or knee if convenient for the operator.

Two switches may also be placed in series, for applications where the worker's safety requires that his hands be kept away from a machine when it is

operating. When installed in this way, both hands must be used in order to activate the machine.

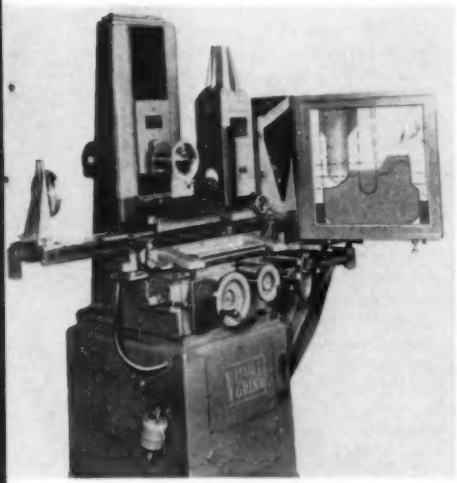
This switch operates on 110 volts, 10 amps. It measures 3⅜ in. in diameter and 1¼ in. in height. The outer shell is molded plastic, with a nonskid rubber base. Both switch and cord are approved by Underwriters Laboratories. Available stripped, or with a variety of plugs.

The Birtcher Corp., 4371 Valley Blvd., Los Angeles 32, Calif. **T-1-1831**

Grinder

A recently developed precision grinding machine permits continuous inspection by an operator grinding steel or tungsten carbide.

A large-sized optical screen—a part of the machine itself—is situated to the operator's right as he faces the controls



of this Visual-Grind, thus uniting existing optical possibilities with conventional surface grinding activity.

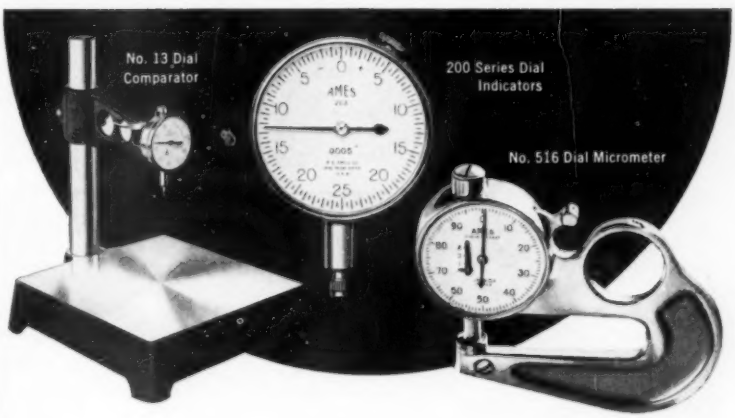
Semiskilled toolmakers are able to operate the machine successfully because of the progressive control of tolerances made possible through the built-in optical comparator.

Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland, Ohio. **T-1-1832**

Plastic Aluminum

Atomized aluminum metal has been combined with a patented vinyl vehicle by the Woodhill Chemical Co., 1391 E. 33rd, Cleveland, Ohio, to develop a metal in putty form called Duro plastic aluminum. This product is ready to use as it comes from the tube or can

AMES



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and requires no catalysts or hardening agents. Applied cold, it will adhere to metal, wood, leather or other surfaces, air-dries to a metallic hardness in a few hours, and may be filed, sanded, drilled or tapped.

A major use of the substance is as a blemish remover for steel castings and other metal products where it works much as plastic wood works on wood. In the aircraft industry, the product can be used as a filler, and as a method of contouring the leading edges on aircraft.

Plastic aluminum is not affected by oil, water, gasoline or naphtha; will withstand heat up to 600 F; will resist shock and abrasion; and has a minimum amount of shrinkage.

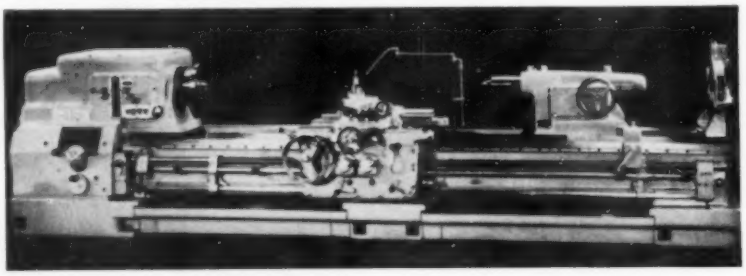
A special solvent is available for thinning the product to brushing consistency. **T-1-1841**

Engine Lathe

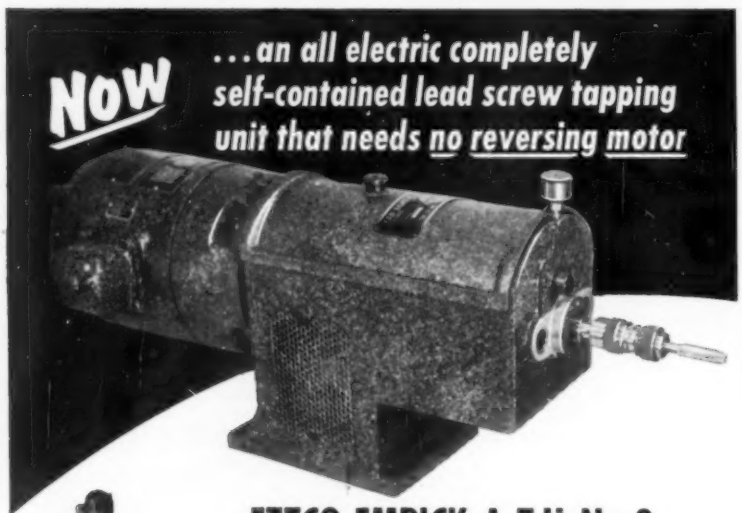
A 32-in. engine lathe that provides a full 75 hp for extra heavy hogging cuts and removes metal at less cost has been designed by Axelson Mfg. Co., Div. of U. S. Industries, Inc., P. O. Box No. 58335, Vernon Sta., Los Angeles, Calif.

Greater structural rigidity has been built into the machine with heavier sections in both the cross and compound slides to minimize deflection during use of the tracer with its increased slide travel.

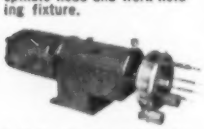
A horsepower indicator allows selection of feeds and speeds to utilize maximum output of the motor, while a 2-lever shift allows easy, quick selection of spindle speeds from the range of 6 to 750. The 81 feeds range from 1005 to 0.35. A standard motor is V-belted to the headstock gearing without benefit of a clutch, although a clutch is provided for horsepowers lower than 75. Starting and stopping of heavy inertia loads is done by electrical plugging.



Any combination of threads from 1 to 30 tpi can be cut through change gears conveniently located in the back of the machine. An extra thread or feed selection may be made at the apron without returning to the gearbox. Selection of any of these 30 threads or 81 feeds is conveniently made by a single lever and dial positioner in the gearbox. **T-1-1842**



The ultimate in tapping speed and economy. A.T.U. No. 3 Lead Screw Tapping Machine with Ettco-Emrick multiple spindle head and work holding fixture.



A. T. U. No. 3 Lead Screw Tapping Unit with Ettco-Emrick multiple tapping head.

ETTCO-EMRICK A.T.U. No.3

with forward and reverse electric clutches

Fastest, most accurate and simplest method of lead screw tapping yet devised! Utilizes instantaneous-acting forward and reverse electromagnetic clutches to make tapping easy and automatic. Check these features:

1. All-electric operation and control.
2. No reversing motor required — electromagnetic clutches control tap direction.
3. Built-in rheostat control permits torque of clutches to be adjusted over a range of from 0 to equivalent of 2 hp.
4. Thread depth control to within ¼ turn of tap.
5. Readily interchangeable lead screws and nuts.
6. Operates in any position—horizontal, vertical or at any angle.

The A.T.U. No. 3 Lead Screw Tapping Unit can be incorporated into a limitless variety of tapping set-ups using Ettco-Emrick fixed or adjustable spindle multiple heads, work holding fixtures, etc.

Bulletin No. A.T.U. has details. Send for a copy.

ETTCO TOOL CO., INC.
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-184

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Glass Cutter

Glass may be cut to pattern and "cracked-off" successfully with an automatic glass-cutting machine that replaces hand operations and speeds up glass production.

The machine is available in a series of sizes capable of automatically cutting and cracking off glass circles and other patterns from 2 to 6 in. in diameter. Equipment will be supplied for accommodating even larger designs. The machine also can be furnished with automatic loading and unloading equipment to make the entire operation automatic.

Capacity of the machine is approximately 1,200 pieces per hour.

Biddle Engineering Co., Box 73, Warrendale, Pa. **T-1-1843**

Technical Shorts...

Experiment with Industrial Uses for Transistors

APPLICATIONS where transistor properties may be utilized to special advantage in the industrial field are now being discovered even though their use still is not widespread. Experimental designs by Westinghouse engineers indicate future possibilities in this direction. In the metalworking industry, a device with ability to sense presence of hot metal is necessary in many instances. It is for these applications that a hot-metal detector utilizing a photo-transistor as an infrared sensing device is being studied. The device also uses transistors in the amplifying circuit. It can be used in any application where a metal object hotter than 700 F must be detected and a signal transmitted to indicate that presence.

Advantages of such a transistorized hot metal detector over photoelectric equipment are the increased sensitivity to infrared radiation, and the transistor's inherent ability to withstand wear in such applications.

Another experimental industrial use of transistors is as static semiconductor elements in a constant current motor control. Such a control could, for example, be used for maintaining constant horsepower on a steel mill reel drive. An experimental ¾-hp d-c shunt motor being used as a driving motor, has sufficient capacity for motors up to 3 hp. It not only has the advantages inherent in its all-static nature, but also provides unusually rapid response and, in addition, offers its services in an extremely small control package.

* * *

Initiate Studies of Electroplating

TWO RESEARCH PROJECTS are being initiated by the American Electroplaters' Society. One, on micro-throwing power will be conducted at the Virginia Institute for Scientific Research at Richmond, Va., under the direction of Dr. Henry Leidheiser, Jr. The second, on the mechanism of plating, which will cover polarization, cathode reactions, etc., will be conducted at the University of Pennsylvania under direction of Dr. J. O'M Bockris and Dr. B. E. Conway of the John Harrison Laboratory of Chemistry.

Develop New Metal Cleaning Technique

A TECHNIQUE for cleaning metal which promises greater efficiency and economy has been developed by Electro-Chemical Engineering Co. Ltd. of England. In the process, two antipathetic liquids are applied simultaneously to a metal surface before assembly, painting or electroplating. The liquids do not mix, but act independently of each other. One is a solvent which dissolves oil and grease; the second is an aqueous or emulsified cleaner to dissolve brazing residue or other water soluble compounds, and wets and disperses such nonmatellic particles as chalk, silica and pumice.

Work is either dipped through the upper solvent layer into the lower emulsion cleaner, or work is sprayed with streams of both liquids together. Either method accomplishes satisfactory application.

The two liquids, called Di-phase cleaners, may be used successfully in place of trichlorethylene vapor degreasing, and at considerably less cost. They are nontoxic and, to some degree, rust inhibiting.

CUT OUT CHATTER

GRIND WITH RED-E PRECISION ANTI-FRICTION CENTERS

—and eliminate down-time changing wheels, diamonds and coolants—have micro finish, *always!*

Grind with RED-E and be sure!

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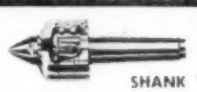
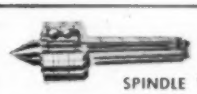
TWO TYPES FOR YOUR NEEDS


SHANK TYPE


SPINDLE TYPE

TAPERS AVAILABLE

Morse	B&S	Jarno	Norton	Landis
1 to 6	5 to 15	4 to 20	10 to 16	.8125, 1.335, 1.750
2 to 7	7 to 18	6 to 20	10 to 24	.8125, 1.335, 1.750

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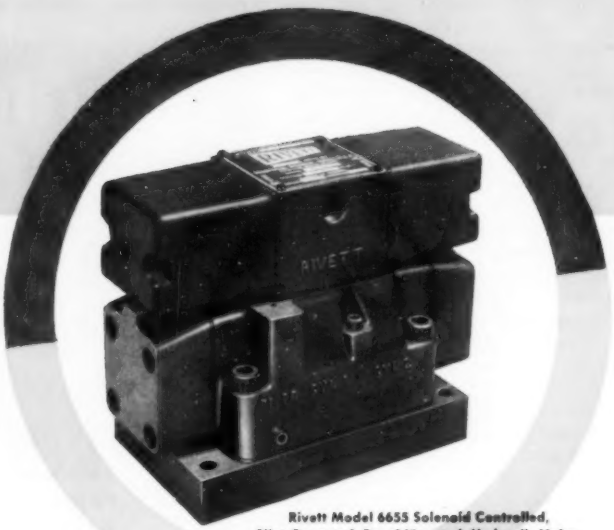

Rivett Model 6655 Solenoid Controlled, Pilot Operated, Panel Mounted, Hydraulic Valve.

Rivett Panel Valves
feature interchangeable sizes

By changing pipe tap size in steel subplate, the 1″ basic valve may be used for either ⅜″, ½″, ¾″, or 1″ I.P.S.; and the 1½″ basic valve for 1¼″ and 1½″.

CORRECT SIZE IS ALWAYS AVAILABLE

and here's another important feature!
GREATER FLOW CAPACITY

Flow capacities are rated at a higher G.P.M. at less velocity per ft. per sec. For example: the 1″ size is rated at 28 G.P.M. at 15 ft. per sec.

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Men at Work

Appointments of **John H. Harris** as vice-president in charge of planning and of **Wallace T. Gray** as general works manager have been made public by Brush Electronics Co. Mr. Harris has been vice-president and general works manager for the firm since 1948, directing manufacturing, production control, maintenance and inspection. Mr. Gray, a member of ASTE's Cleveland chapter, formerly was works manager for the Leece-Neville Co.

At the recent meeting of the board of directors of Allied Products Corp., **Carl C. Kamphauses** was named to the position of executive vice-president. Under the direction of the president, he will be in charge of all metal parts production operations.

When Charles F. Myers was made president of Morse Twist Drill and Machine Co., other changes were also made in the organizational setup of the company's executive leadership. In this connection, **James Y. Scott,** former president, was made chairman of the board, and **J. J. Hayes** was elected executive vice-president and general manager. Mr. Scott now serves also in the capacity of board chairman for Van Norman Machine Co., Van Norman Automotive Equipment Co., Super Tool Co. and Insuline Corp. He is a member of ASTE'S Springfield (Mass.) chapter.

Appointment of **John T. Ellis, Jr.** to the post of chief engineer has been announced by Hanna Engineering Works. He will be responsible for engineering activities in the product, research and development, methods, industrial and plant maintenance engineering divisions of the company.

At the annual meeting of the Metal Treating Institute, **H. N. Bosworth** of Bosworth Steel Treating Co., was elected to serve as president for the coming term of office. Other officers elected included **K. U. Jenks,** of Lindberg Steel Treating Co., Inc., vice-president, and **L. G. Field** of Greenman Steel Treating Co., treasurer. Mr. Field is a member of ASTE's Worcester chapter.

At the same time Louis Polk was elected president of the National Machine Tool Builders Assn., the organization also named **Jerome A. Raterman,** president of Monarch Machine Tool Co., as first vice-president; **Alfred V. Bodine,** president and treasurer of The Bodine Corp., as second vice-president and director; and re-elected **Perrin G. March, III,** president of The Cincinnati Shaper Co., to office of treasurer. **William E. Rutz,** executive vice-president of Giddings & Lewis Machine Tool Co., and currently a director of NMTBA, was elected secretary. He also is a member of ASTE's Fond du Lac chapter.

During its tenth annual convention, National Tool & Die Manufacturers Assn. elected **Joseph N. Huser,** president of B & H Specialty Co., Inc. to the office of president. Also elected were **Herbert Harig,** president of Harig Mfg. Co., as first vice-president; **Philip R. Marsilius** of The Producto Machine Co., second vice-president; **Robert C. Renner,** The East Dayton Tool & Die Co., treasurer; and **Harold G. Murdock,** of Arrowsmith Tool & Die Corp., secretary. Messrs. Huser, Marsilius and Murdock are also members, respectively, of ASTE's Indianapolis, Fairfield County and Los Angeles chapters.

Earl M. Douglas has been named vice-president of Dana Corp. with responsibility over technical activities relating to product engineering. Since 1928, Mr. Douglas has been with Studebaker, serving in various engineering capacities dealing with quality, production and executive management.

At a recent meeting of the board of directors of Vanadium-Alloys Steel Canada Ltd., **Gordon Barker** was elected vice-chairman of the board. He previously served as an executive officer of Canadair Ltd. and has been president of Vanadium Alloys Steel Canada Ltd. since December, 1954. Succeeding him in the presidency is **Edward P. Geary** who until recently was executive vice-president of Atlas Steels Ltd.

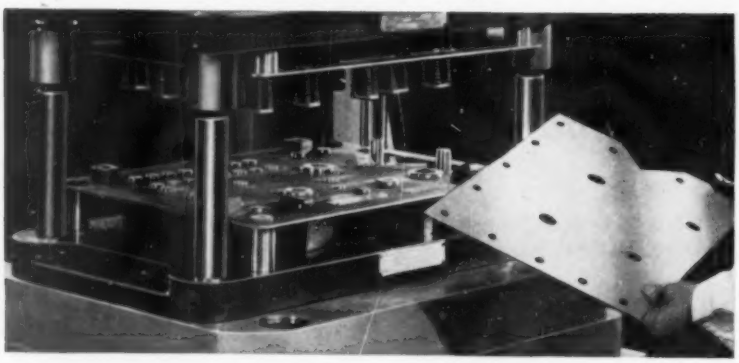
Charles F. Myers has been elected president of Morse Twist Drill and Machine Co. Previously he served the company as vice-president in charge of sales.

V. S. Lazzara, president of Casting Engineers, Inc., has been elected president of Investment Casting Institute at its recent annual meeting in Detroit.

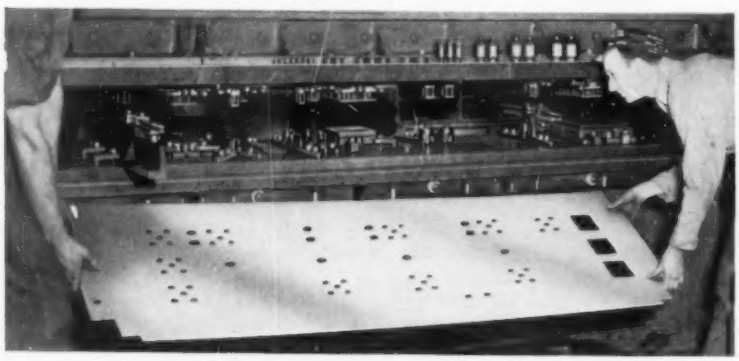
Louis Polk, president of The Sheffield Corp., was elected president of National Machine Tool Builders' Assn. He also is a member of ASTE's Dayton chapter.

Grant S. Diamond was recently elected president of the Grinding Wheel Institute for 1956. He is president of the Flectro Refractories & Abrasives Corp.

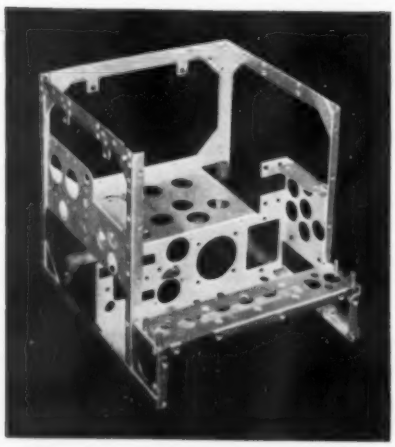
OVER 2,000 PLANTS *are making up their Metal Perforating Die Sets by Whistler methods*



WHISTLER **MAGNETIC PERFORATING** DIES



WHISTLER **ADJUSTABLE PERFORATING** DIES



- Lower die-making costs.
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George E. Shoup is new executive vice-president at The Dumore Co. where he has been associated in various executive capacities since 1941.

At the annual meeting of the Gray Iron Founders' Society, Inc. **C. H. Ker**, president of The Dalton Foundries, Inc. was re-elected president of the organization. **J. Scott Parrish, Jr.**, of The Richmond Foundry and Mfg. Co., Inc., was elected new vice-president of the society. Other officers re-elected were: **C. H. Meminger**, Posey Iron Works, Inc., secretary; and **W. O. Larson**, The W. O. Larson Foundry Co., treasurer.

Appointment of **John N. VanEpps** as vice-president of manufacturing has been made public by Madison Mfg. Co. and Madison Industries, Inc. Mr. VanEpps, who brings to his new position a broad background of engineering and manufacturing experience, will now head all manufacturing activities for both companies.

Fred S. Haas has been named director of product engineering of the National Automatic Tool Co. For the past 30 years he has been associated with Cincinnati Milling Machine Co.

Pressed Metal Institute at its annual meeting elected **Joseph J. Boehm** of The Boehm Pressed Steel Co. to serve as institute president. **Bruce Krasberg** of R. Krasberg & Sons Mfg. Co., and **C. E. Stryker** of Maysteel Products, Inc., were elected vice-presidents; and **W. B. Gemmill** of The American Stamping Co., was named secretary-treasurer.

Donald N. McPherson has been appointed general manager of Willey's Carbide Tool Co. He will be responsible for the production and coordination of the company's expaned tungsten carbide metal manufacturing division and the tool manufacturing division.

George F. Meyer has been named general superintendent of The Warner & Swasey Co. Mr. Meyer, who joined the company as special apprentice in 1947, has been first shift superintendent of the Cleveland plant and also, since September, maintenance superintendent.

United Engineering Trustees, Inc. recently elected **Walter J. Barrett** as president for the coming year. Mr. Barrett is treasurer and a director of the American Institute of Electrical Engineers which he represents on the Board of UET.

Trade Literature

For Free Booklets and Catalogs—Convenient Request Card on Page 169

Control Devices

Illustrated 68-page catalog GEC-1260A presents line of general purpose control devices; includes photos, book prices, wiring diagrams and dimensions; also compares applications and merits of manual and magnetic control, and across-the-line and reduced-voltage control; special section aimed at aiding in control selection. General Electric Co., Schenectady 5, N. Y. **L-1-1**

Automatic Programming

Eight-page booklet EL-280, "Automatic Routines for Commercial Installations," by Mary K. Hawes, supervisor of commercial programming for Remington Rand Univac Div., outlines system for automatic programming of Univac, describing the operation in detail. Remington Rand Univac Div., Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y. **L-1-2**

Gaging

Paper on "The Correlation between Screw Thread Standards and Gaging Systems," written by Clinton V. Johnson, offered in 12-page pamphlet J-55 as an authoritative approach to the controversy between effective and actual checking of minimum-metal on screws and tapped holes. The Johnson Gage Co., 534 Cottage Grove Rd., Bloomfield, Conn. **L-1-3**

Resistance Welding

Up-to-date technical data and information on electric resistance welding research and application to problems of industrial fabrication includes description of projects carried on at Douglas Aircraft, General Electric Co., Pratt & Whitney Co., Inc., Ford Motor Co. Aircraft Div., Handley Page, Ltd., and other facilities. Request only on professional letterhead directly to Technical Editor, Sciaky Research Center, 2311 Purdue Ave., Los Angeles 64, Calif.

Grinding Wheels

Extensively illustrated 8-page brochure presents information on company's line of vitrified and resin bonded wheels, covering applications and emphasizing advantages. Electro Refractories & Abrasives Corp., 344 Delaware Ave., Buffalo 2, N. Y. **L-1-4**

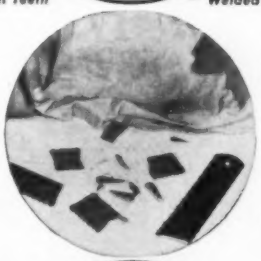
Presses

Latest design features and improvements in complete capacity range of double-action straight side presses emphasized in 28-page New Series D catalog illustrated by photos, drawings and graphs; shows representative models in line, with descriptions, and tables of dimensions, and specifications. Danly Machine Specialties, Inc., 4358 W. Roosevelt Rd., Chicago 50, Ill. **L-1-5**

Metallizing

A wide range of applications of metallizing in the production of electrical and electronic equipment illustrated and described in Metco Bulletin 120; includes data on bond strength, conductivity characteristics, permissible coating thicknesses, circuit tests, surface preparation and spraying methods. Metallizing Engineering Co., Inc., 1101 Prospect Ave., Westbury, Long Island, N.Y. **L-1-6**

Features Essential to Top Hack Saw Blade Performance



UNBREAKABLE—to saw FASTER.
Composite construction (a narrow high speed steel tooth edge electrically welded by the MARVEL-invented process to a tough, non-brittle alloy steel body), means that MARVEL high-speed-edge can be subjected to the MAXIMUM feed pressure that any hack sawing machine is capable of applying. MARVEL blades need not be "babied" for fear of breakage!

SHATTERPROOF—for SAFETY.
MARVEL blades never shatter or "explode" as do the ordinary "brittle" blades shown at left which so often cause personal-injury accidents such as the loss of an eye or severe laceration and expensive damage to the sawing machine. Operators who use MARVEL blades exclusively soon "get the habit" to apply heavier feeds, greater blade tension, higher speeds—to do their work faster, because they know they are SAFE with MARVEL.

SHARPER, PREMIUM-STEEL TEETH—to wear LONGER.
Teeth are accurately machined by a MARVEL-invented process that assures sharper tooth points and positive uniformity of tooth shape and degree of set from end-to-end of every MARVEL blade. The steel used in the tooth edge is carefully selected from the finest high speed steels available throughout the world, regardless of cost or source—truly premium steels, without premium cost.

QUALITY CONTROL—to assure UNIFORMITY.
With more than a quarter century of *experience* in inventing, perfecting, and producing welded-edge hack saw blades, MARVEL has provided its own laboratory with the most modern metallurgical instruments and techniques known to the applicable sciences for the specific purpose of maintaining highest possible quality control. Coupled with rigid tests and meticulous inspection of every MARVEL blade, uniform quality is assured.

These are only a few features that make MARVEL High-Speed-Edge Blades such outstanding performers.

Ask for the latest MARVEL Cutting Tool Bulletin and the name of your closest MARVEL Distributor.

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

Manufactured only by
ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-189

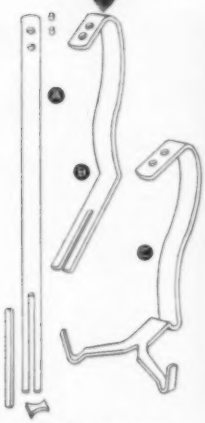
top performance IN MASS PRODUCTION

60 vaporizer stands per minute . . . automatically formed in one operation on an A. H. Nilson combination press and 4-slide. Kaz Vaporizer stands are a proof that clever product design, combined with precision tooling by Nilson, increases production and lowers costs.

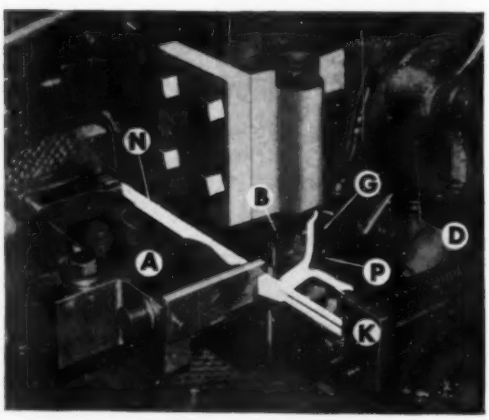
NILSON 4-SLIDES FEATURE—

- ONE-MAN OPERATION
- FORMING OF WIRE OR RIBBON METALS FROM THE COIL
- ONE FAST, AUTOMATIC OPERATION WHICH STRAIGHTENS, FEEDS, PIERCES, BLANKS, SWAGES, STAMPS OR COINS, CUTS OFF, FORMS
- CRITICAL TOLERANCES UP TO .002 ON ANY RUNS
- FAST TOOL AND DIE CHANGING
- WIDE SIZE RANGE—FORMS WIRE UP TO ½ IN. DIA. IN FEEDS TO 32 IN. MAX. AND RIBBON STOCK UP TO 3½ IN. WIDE
- PRESS SECTIONS—5 TO 30 TON CAP.
- HEAVY DUTY MODELS—50 AND 75 TON CAP.

Without obligation, Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogue . . . the first step to increased production.



Stand is zinc-plated steel strip 0.05 in. thick by 0.625 in. wide . . . made in steps A, B and C.



Final step in forming Kaz stands on Nilson 4-slide. Feet are spread, bent, crimped (G) with workpiece (P) on centerpost while next piece (N) is being cut off. Stop (K) on right slide (D) backs off after cut and workpiece (P) is wrapped around centerpost by die (A) when finished part is clear.

A.H. NILSON MACHINE COMPANY

1520 RAILROAD AVE. BRIDGEPORT 5, CONN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-190

Surface Plates

Illustrated 67-page technical manual answers questions about company's black granite surface plates; describes manufacture of the plates, and precision inspection accessories available gratis from the manufacturers. Collins Microflat Co., 2326 E. 8th St., Los Angeles 21, Calif. **L-1-7**

Grinding Wheels

Catalog No. 5E covers line of grinding wheels; well illustrated by photos and drawings to show details of various items in the line; includes dimensions, specifications and prices. The Peninsular Grinding Wheel Div., 729 Meldrum Ave., Detroit 7, Mich. **L-1-8**

Reinforced Plastic

Illustrated reference brochure on Scotchply reinforced plastic explains what it is, its applications and advantages; gives design and performance data, application procedures, and discusses types and forms of the substance. Includes prices. Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. **L-1-9**

Motors and Drives

Informative Bulletin No. 1750, "Motors and Drives for the Machine Tool Industry" deals with special and standard motors and adjustable speed drives; includes comprehensive descriptions, illustrations, installation information, and technical data on electrical features. The Louis Allis Co., Milwaukee 7, Wis. **L-1-10**

Power Tools

Extensively illustrated 51-page catalog describes company's line of power tools for cutting, shaping, drilling and finishing wood, metal, fiber and plastics. Boice-Crane Co., 934 Central Ave., Toledo 6, Ohio. **L-1-11**

Abrasive Disks

Complete line of abrasive disks and cylinder wheels presented in extensively illustrated 20-page catalog AC-55; chart shows variable factors influencing selection of proper disk or wheel for specific job. Gardner Machine Co., Beloit, Wis. **L-1-12**

Metalworking Machines

Three folders, on Arboga (1) vertical millers, (2) grinding machines, and (3) drill presses, describes and illustrates equipment with emphasis on special features and advantages. Masters Precision Tools, 3613 Archer, Chicago 9, Ill. or 118-122 Church St., Newtown, Ohio. **L-1-13**

Steel

Extensively illustrated brochure, "Alloy Steels," describing two low-alloy, high-strength steels; covers company's quality control program, as well as providing pertinent tabulated technical information. Sheffield Steel Div., Armco Steel Corp., Houston, Texas and Kansas City, Mo. **L-1-14**

Plastic Welding

Four-page bimonthly publication "Plastics Welder and Fabricator" presents information on various aspects of plastic welding and fabrication. American Agile Corp., P. O. Box 168, Bedford, Ohio. **L-1-15**

Power Sawing

Pocket-size 180-page "Power Sawing Handbook" concentrating on cutoff techniques; summarizes existing methods, outlines how to estimate costs, explodes misconceptions, suggest correct approaches to cutoff problems; includes such points as significance of high-speed steel in its new form as a flexible saw band. Request on company letterhead to The Do All Co., Des Plaines, Ill.

Automatic Production

How successful production line layout is combined with automatic mass machining methods for lower cost and higher production is described and illustrated in 7-page fold-out brochure, "Automatic Progress-Thru Machine"; pictures 4 such machines which are part of a new complete cylinder head production line; includes schematic drawings describing operating sequence of line in detail. W. F. & John Barnes Co., Dept., P-TM, 301 S. Water St., Rockford, Ill. **L-1-16**

Precision Production

Extensively illustrated 32-page brochure, "Production Processing and Service Facilities," provides pictorial review of Division's productive capabilities for plate processing, mass production of small precision parts, tool and die production, metals processing, and assembly and development; tab indexed for reference. Allied Products Div. of Hamilton Watch Co., Lancaster, Pa. **L-1-17**

Hydraulic, Air Components

Catalog No. 555, "Hydraulic and Air Components by Star Jack," offers 36 pages describing features, specifications, and applications of company's pumps, cylinders, jacks, braces and other units; illustrated. Star Jack Co., Inc., 420 Lexington Ave., New York 17, N. Y. **L-1-18**

A TRANSPARENT ALL-CHEMICAL SOLUTION FOR GRINDING

Lusol K-7 is a new all-chemical liquid concentrate designed for a wide variety of grinding operations. It is recommended for use on all steels and is particularly suited for cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. Instantaneously soluable in any water, hard or soft, it forms a clear, transparent, colorless solution that resists contamination, settles chips super-fast, and remains clear after repeated use. It is non-foaming and runs absolutely flat under all conditions. It provides maximum rust protection for all ferrous metals, including cast and malleable irons. It maintains clean wheels at all times. They just don't load up when you use Lusol K-7. For better grinding every time, use Lusol K-7. Write for complete information.

THE Lusol LINE

. . . BETTER PRODUCTS FOR BETTER METAL WORKING

F. E. ANDERSON OIL CO., INC.

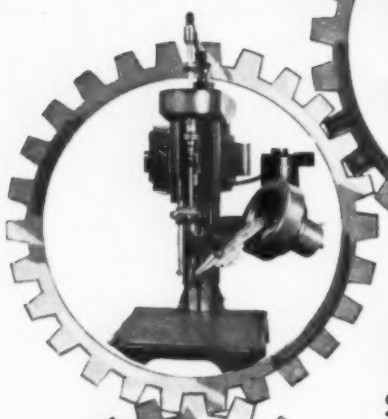
PORTLAND, CONNECTICUT

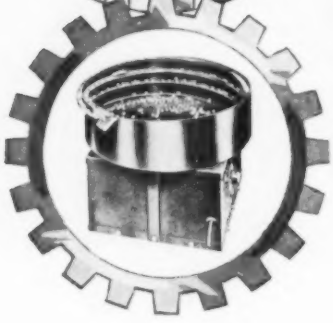
BA055

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-191

Are You Geared to Meet Today's PRODUCTION DEMANDS?

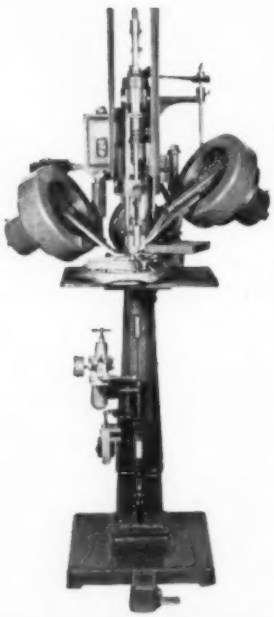
MAXIMUM OUTPUT — MINIMUM COSTS





DPS POWER SCREWDRIVERS and SELECTIVE FEEDERS *enable you to meet requirements in today's competitive market.*

● Line up this modern "gear train" for added profits. The DPS Power Equipment line is complete and flexible . . . Adaptable to the majority of production bottlenecks . . . It could be the answer to your problem . . . Tell us your story . . . Send for detailed catalog . . . Write today.



DETROIT POWER SCREWDRIVER CO.

2799-A W. FORT ST. DETROIT 16, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-192

Engineering Service

"A Guide for Selecting an Engineering Firm" offered as aid to those responsible for their company's entering new product fields or for those who need outside engineering help; explains differences between engineering installation, project engineering and engineering design firms; outlines criteria for selecting outside firm; uses case histories for examples. The Teller Co., Group P, Butler, Pa. **L-1-19**

Tempering Chart

Condensed tempering chart for tool steels provides quick, handy reference to data on carbon tool steel, low or high manganese oil hardening, stainless steels, various chromes and other alloys; backed by heavy cardboard for durability. Lindberg Steel Treating Co., 1975 N. Rubt St., Melrose Park, Ill. **L-1-20**

Notching Presses

Complete line of notching presses and attachments described and illustrated in 16-page Catalog 55 pointing out features and advantages, and outlining specifications; attachments covered include skip notcher, automatic blank feeder and an index ring fixture. The V & O Press Co., Div. Emhart Mfg. Co., Hudson, N.Y. **L-1-21**

Solvent Recovery

The Columbia activated carbon system of solvent recovery discussed in 36-page booklet, Form 4410D, which gives technical data on activated carbon and stresses efficiency and economy of recovering solvent vapors in many industries; illustrated. Carbide and Carbon Chemicals Co., Division of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. **L-1-22**

Extruded Stock

Revised 20-page "Berylco Product Directory" covers extruded rod and bar stock and seamless beryllium copper tubing available from the company; also lists and describes characteristics of beryllium copper, beryllium aluminum and beryllium nickel alloys, of beryllium metal and oxide, and wrought, forged and cast beryllium copper alloys and beryllium copper safety tools. The Beryllium Corp., Reading, Pa. **L-1-23**

Clutch Controls

Illustrated Catalog 65 covers company's improved line of electric two-hand clutch controls for industrial machines, pointing out important features and advantages. Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill. **L-1-24**

Who's Meeting - and Where

Jan. 9-13. Society of Automotive Engineers, Inc. Annual meeting. The Sheraton-Cadillac and Statler Hotels, Detroit, Mich. For more details, contact society headquarters, 29 W. 39th St., New York 18, N. Y.

Jan. 18-20. Society of Plastics Engineers. 12th annual conference, Statler Hotel, Cleveland, Ohio. Details are available from S. A. McElroy, Hercules Power Co., 865 Union Commerce Bldg., Cleveland, Ohio.

Jan. 23-26. Plant Maintenance & Engineering Conference and Show, Convention Hall, Philadelphia, Pa. Complete facts are available from producers of the events, Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

Feb. 1-2. Armour Research Foundation of Illinois Institute of Technology and Chicago Section of American Welding Society jointly sponsoring second annual Midwest Welding Conference. Details are available from the Institute office, 35 W. 33rd St., Technology Center, Chicago 16, Ill.

Feb. 9-10. The Society of American Military Engineers. Annual technical meeting, Palmer House, Chicago, Ill. Get more information from society office, 808 Mills Bldg., Washington 6, D.C.

Mar. 8-9. The Society of the Plastics Industry Canada, Inc. 14th annual Canadian conference, Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada. More information may be had from The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y.

Mar. 19-21. Society of Automotive Engineers, Inc. National production meeting and forum, Hotel Statler, Cleveland, Ohio. More information may be had by writing society offices, 29 W. 39th St., New York 18, N. Y.

May 3-9. American Foundrymen's Society. 60th annual foundry congress and exhibit. Convention Hall, Atlantic City, N. J. For further facts, contact society headquarters, Golf & Wolf Rds., Des Plaines, Ill.

May 14-17. Design Engineering Show. First of annual shows to be devoted to original equipment which goes into manufacture of finished products. Convention Hall, Philadelphia, Pa. Contact exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York, N.Y.

June 5-7. The Material Handling Institute, Inc. Technical sessions and Exposition, Cleveland Auditorium, Cleveland, Ohio. Complete facts may be obtained from institute office, Room 759, One Gateway Center, Pittsburgh 22, Pa.

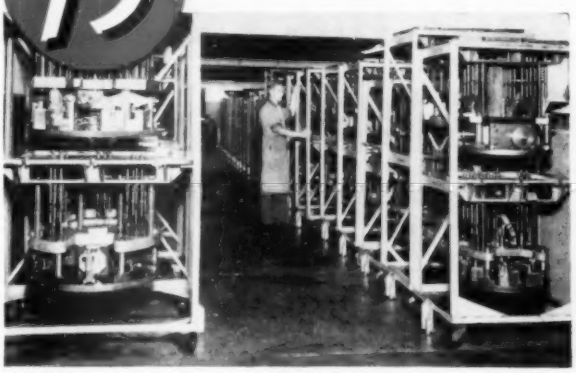
June 17-21. American Electroplaters' Society. 43rd annual convention, Hotel Statler, Washington D. C. Full information may be had from society office, 445 Broad St., Newark 2, N.J.

June 17-22. American Society for Testing Materials. 59th annual meeting and 12th apparatus exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J. Write for particulars to society headquarters, 1916 Race St., Philadelphia 3, Pa.

June 3-8. Society of Automotive Engineers, Inc. Summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. More facts are available from society office, 29 W. 39th St., New York 18, N. Y.

June 11-15. The Society of the Plastics Industry, Inc. Seventh national plastics exposition, New Coliseum, New York, N. Y. Get advance information from society office, 67 W. 44th St., New York 36, N. Y.

75 SEIBERT-EQUIPPED Machine Heads at WOODWARD GOVERNOR COMPANY



Simplify Tooling Changeovers . . . Help Build Precision Parts Faster

At Woodward Governor Co., Rockford, Ill., an ingenious method of machine head storage reduces setup time and minimizes damage to spindles and tools. The main illustration above shows how 75 interchangeable heads, equipped with more than 1500 Seibert precision-built spindles, are neatly arranged and numbered to permit fast and easy removal in and out of storage to machine location. Woodward Governor, another company whose production requires precision tolerances and high quality, has been using Seibert tools for more than 5 years.

3 Reasons Why Users Specify SEIBERT

Investigate the 3 reasons why users specify Seibert tools. You will find they meet exacting tolerance requirements . . . you save money for Seibert tools are lot produced in a wide range of standard sizes . . . and your orders receive prompt handling because Seibert specializes in production tools only.

FREE DATA

Write for Folio 1-30 illustrating and describing the complete line of Seibert Multiple Drill Spindles.

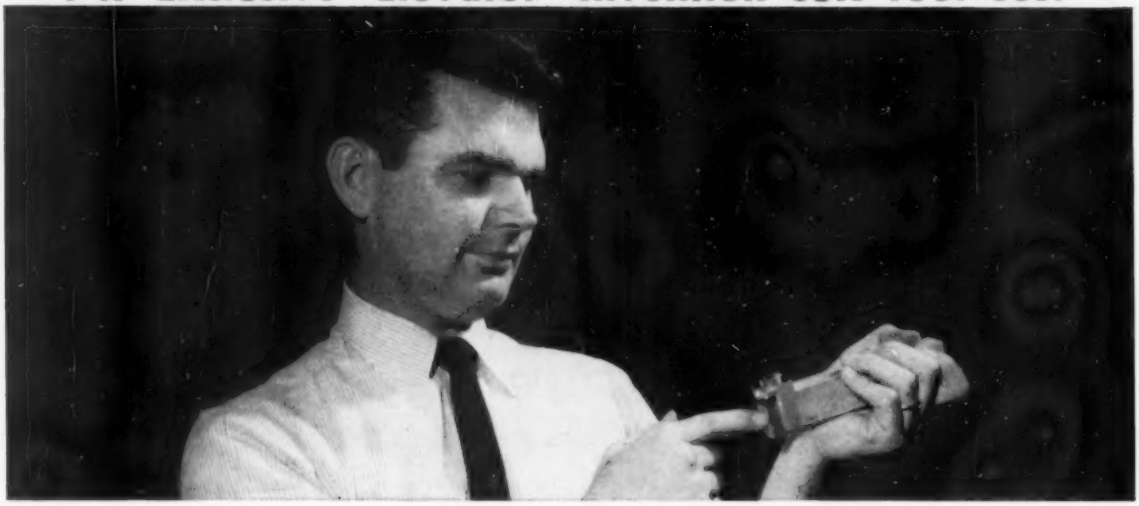
SEIBERT & SON, INC. CHENOA, ILLINOIS

Quality MULTIPLE DRILL SPINDLES AND PRODUCTION TOOLS

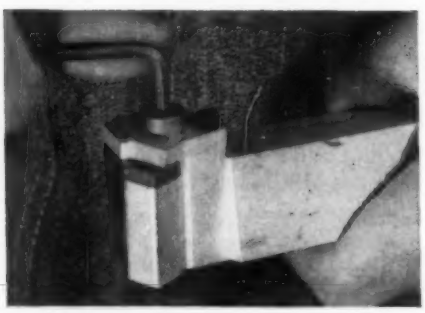
SEIBERT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-193

V-R Exclusive "Elevator" Invention Cuts Tool Cost



Only the V-R Toolholder
has the Patented "ELEVATOR"...



Only a matter of seconds to index the insert . . .

1. Loosen the main screw
2. Index the insert
3. Tighten the main screw

This automatically brings the cutting edge back to center . . . eliminates adjustment of tool shank.

Makes "Throw-Away" Blanks

- **EASIER TO USE**
- **CUTTING EDGE *ALWAYS* ON CENTER**
- **CUTS COSTS 35% TO 50%**

The exclusive V-R elevator provides an adjustable base for the insert . . . saves down time, makes indexing or changing inserts a quick, simple operation. Only the V-R patented elevator permits the use of any length of carbide, including "Throw-Away" blanks. Regardless of carbide length, the cutting edge is always on-center. The replaceable and reversible tool steel elevator is ground to provide a firmer base for the insert and, at the same time, locks the insert solidly in the toolholder. Ask your V-R representative to show you how the patented elevator of the V-R Toolholder can save you money, or write for details and the New V-R Toolholder catalog.

Vascoloy-Ramet CORPORATION

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

MANUFACTURERS OF CEMENTED CARBIDES • CARBIDE TOOLS AND BLANKS • TOOLHOLDERS AND INSERTS • TANTUNG TOOLS • DIES • MINING TOOLS • INVESTMENT CASTINGS

820 MARKET STREET WAUKEGAN, ILLINOIS

Field Notes...

New melting facilities that will provide the metalworking industry with an additional 250,000 lb of high alloy steels per month have been opened by Allegheny Ludlum Steel Corp. This new consumable electrode vacuum melting department came into being after extensive research and development on the part of the company's metallurgists. Too, the company has built up considerable experience in consumable electrode vacuum melting of metals like titanium and zirconium.

In the past, availability has been a primary consideration for customers needing substantial quantities of superalloys. With the new equipment, Allegheny Ludlum believes it can make 10 times as much high quality superalloys, tool or stainless steels as industry has been using in any given month. The department also has been designed so that it may be rapidly expanded to four times present size.

v v v

Engineers and designers are eligible to enter the $1,000 prize contest fostered by American Silver Co. The competition has been instituted to stimulate interest in creation of new uses for stainless steel strip that can be rolled down to thicknesses as low as 0.0005 in. and to tolerances as close as ±0.0001. First prize for the best new application of thin gage and/or high-precision tolerances stainless steel strip, is $350. A total of 31 cash awards will be made.

More complete details concerning the competition, which closes midnight, May 30, 1956, are available from the chairman of the Prize Awards Committee, American Silver Co., Flushing 54, N. Y.

name change

Following stockholder approval at a recent meeting, the name of Consolidated Engineering Corp. was officially changed to Consolidated Electrodynamics Corp. Because of its original name, the company had been unable to qualify for interstate business in certain states; this forced creation of a special subsidiary, CEC Instruments, Inc., to operate in such states. That unit has now been dissolved.

At the same time, company officials announced that Consolidated Vacuum Corp., subsidiary of Consolidated Electrodynamics, also has been dissolved and its activities combined with those of the parent firm. It now is known as the Consolidated Vacuum division.

anniversaries

To commemorate the 75th anniversary of its operation Tinius Olsen Testing Machine Co. has published a special issue of *Tinius Talks*. The special illustrated publication traces development of modern testing and balancing machines since the first Tinius Olsen's universal testing machine was developed in 1880. From this point, it deals with major advances in design and discusses modern techniques and applications. Copies of the special issue are available from the company, 5156 Easton Rd., Willow Grove, Pa.

v v v

Celebration of its 75th year was marked by open house for the employees and families of The Warner & Swasey Co. During the three-quarters of a century in the field, the company has grown from a single small machine shop where Worcester R. Warner and Ambrose Swasey first produced their original turret lathes, to the present manufacturing facility covering many acres and incorporating several large plant structures.

moves

In step with its general program of expansion, Grobet File Co. of America, Inc. has moved its offices, factory and warehouse from New York City to a new building in Carlstadt, N. J. The move gives the company considerably enlarged quarters plus additional adjacent acreage for future expansion.

v v v

Relocation of the plant of Parker-Kalon Div. of General American Corp. has been announced with official opening of the new facility in Clifton, N. J. Only about 20 minutes' traveling time from Times Square in New York City, the new plant provides 267,000 sq ft of floor space, 225,000 of which will be used exclusively for manufacturing. Feature of the plant is its design for flexibility which includes knockout type walls so that manufacturing area can be readily expanded to twice its present size.

Detroit sales offices of Illinois Tool Works and its Shakeproof Div. have moved to new quarters at 1403 E. State Fair. The office occupies all of a new building, giving it considerably enlarged facilities.

expansions

$1½-million is earmarked for expenditure by The Carborundum Co. to modernize and expand its Monofrax refractories plant in Falconer, N. Y. The scheduled program, which will be accomplished in progressive stages during the next 5 years, call for a new building for storage and handling of raw materials and other supplies, and new materials handling and production control equipment.

v v v

Additional facilities for manufacturing operations have been acquired by Ex-Cello-O Corp. at Elwood, Ind., which provides 66,000 sq ft of floor space; a 15-acre plant site at Downey, Calif. is also to be the location of a new 60,000 sq ft manufacturing building.

v v v

A site for a new and much larger steel service plant near Charlotte, N. C. has been purchased by Joseph T. Ryerson & Son, Inc. Reasoning which brought the decision to buy was based on the company's belief in the industrial expansion in the area and certainty of its continued development, and secondly, with the significance of Charlotte's geographical situation for logical distribution within that area. Ryerson has operated a small plant in the city for the past two years.

v v v

More than a 300 percent increase in production of mechanical coil springs and wire configurations will result from operation of a new $1½-million plant for California Spring Co.

v v v

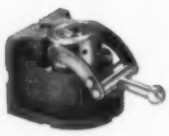
A five-year expansion program encompassing increased productivity, improved product quality, reduction of costs and added facilities for customer services, has been announced by The Carpenter Steel Co. Included in the plans, which will involve a total invest-

Zagar Tools

HOLD YOUR WORK—AND YOUR BUSINESS!

Collet indexing fixture

Collet holding fixture

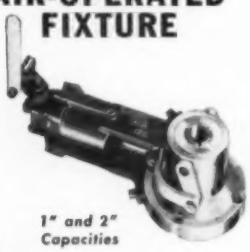


Vertical-horizontal collet fixture

ZAGAR HOLDING and INDEXING FIXTURES

Zagar fixtures offer you a most inexpensive way to machine small parts. Set-up is speeded and much special tooling eliminated. Slot milling, straddle milling, drilling, tapping and grinding of small pieces can be done most profitably with Zagar fixtures, *available from stock.*

AIR-OPERATED FIXTURE



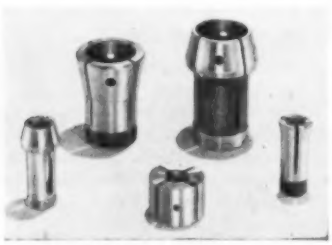
1" and 2" Capacities

Manual or mechanical control is optional on the "Air-O." The cam or chain can be readily connected. Solenoid operation is possible for the valve control. Parts are interchangeable. Far out-speeds hand operation.

COLLET LATHE CHUCKS

1" and 2" Capacities

Zagar chucks are easily adapted to any make of lathe, grinder or rotating spindle. Handles bar stock—lengthwise, with no movement. Speeds loading and unloading. Can be opened and closed while machine is running.



COLLETS, PADS, BLANKS

Five types: No. 310 Zagar Master; Nos. 2 and 6 W. & S.; No. 5-C; No. 6 W. & S. pads. All but Zagar No. 310 are standard machine tool sizes. All collets are made of oil-hardened tool steel; have flat tops for locating purposes.

Write for Engineering Sheets "E-1" on each product.

ZAGAR TOOL, INC.

23892 LAKELAND BLVD.
CLEVELAND 23, OHIO

Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-196

ment of at least $9-million, are the firm's Alloy Tube Div., and Webb Wire Div. Details of the program cover a new plant and equipment, installation of a large hydraulic forging press and an additional arc-melting furnace, a high-speed bar turning machine, and additional heat-treating facilities and handling equipment.

v v v

Further expansion of Snyder Tool & Engineering Co. was made public with announcement of the company's purchase of facilities at 1030 McDougall, near its main plant in Detroit. Need for the additional 18,000 sq ft building grew from requirements for warehousing facilities; the newly acquired structure will replace smaller presently leased facilities in three different locations.

At the same time, Snyder's new $500,000 addition to the main plant is nearing completion.

new offices

Establishment of a combined sales office and warehouse at 18320 W. McNichols Rd. has been announced by Firth-Loach Metals, Inc. William H. Fritz, Jr. has been made district manager and William D. Huston, sales engineer.

v v v

Rodney Metals, Inc. has opened a new office and warehouse at 4312 Pacific Way, Los Angeles 23, Calif. The facility, under the supervision of William Brown, will be known as Rodney Metals of California, Inc. A full line of the company's products will be maintained at the new warehouse.

v v v

New West Coast office for the Research & Control Instruments Div. of North American Philips Co., Inc. have been opened at 1485 Bayshore Blvd., San Francisco. The new headquarters will be managed by Philip I. Wolf who will also assist local Norelco dealers on technical and sales problems.

new activities

As of January 1, 1956, Oster Mfg. Co. will step into the material handling field with the marketing, on an international basis, of a line of multipurpose hand-propelled, hand and battery-operated portable lifts with capacities up to 2000 lb. According to the company's material handling division manager, reasons behind Oster's decision to de-

velop new products and new markets were based first on need to compensate for economic peaks and valleys of machine tool demand and, secondly, to provide means for continuing present multiple shift employment under all business conditions.

v v v

Operation will begin with the new year at the West Coast division plant of RDM, Inc. The new plant will offer complete manufacturing and engineering facilities, particularly to the electronic and aeronautical industries. C. M. Gottschau, vice-president, is in charge of engineering, and Alva K. Hinchman is plant manager.

v v v

Formation of the Agile Plastic Corp. of California has been revealed by Dr. J. A. Neumann, president of the American Agile Corp. The new firm, which is headquartered in the First Western Bank Bldg., Santa Ana, Calif., will be guided and directed by American Agile. It is being organized and supervised by John R. Kearns. Complete production facilities for the California company are expected to be available early in 1956.

corporate changes

With exchange of shares between the two companies, Syntron Co. has become a subsidiary of Link-Belt Co. According to Link-Belt president, Robert C. Becherer, products of the two firms tend to supplement each other. With the unification each company will be able to make "substantial contributions to the other in management, production, distribution and research."

v v v

Announcement of purchase of The Detroit Sintered Metals Corp. has been made by Bunting Brass & Bronze Co. The acquired firm, which now becomes a wholly owned Bunting company, will continue under its present management and will continue manufacturing operations as in the past. However, marketing of its complete output will be through the Bunting organization. Detroit Sintered Metals will operate as an entirely separate company.

v v v

Outstanding stock of the T. R. Almond Mfg. Co. of Willoughby, Ohio, has been acquired by Kennametal Inc. About a year ago, the Almond firm purchased the name, goodwill, trademarks and certain of the physical assets of the T. R. Almond Mfg. Co. of Ashburnham, Mass. Kennametal bought the company to provide additional facilities for the manufacture of Kendex and other metal-cutting tools. Facilities include a modern plant in which work has already started to convert and equip it for new manufacturing operations.

v v v

Uniting of Standard Pressed Steel Co. and Cleveland Cap Screw Co. has brought into existence one of the largest organizations in the fastener industry. Stock of Cleveland Cap Screw was exchanged for an undisclosed number of shares of SPS stock.

v v v

Subject to action by the boards of the respective companies, working arrangements have been made for the merger of Square D Co. and Electric Controller and Mfg. Co. The present understanding calls for 1½ shares of Square D common stock to be issued for each share of Electric Controller. Completion of this proposal is dependent on the boards' approval. According to directors of both companies, the merger will combine complimentary lines of products resulting in greater diversification in various operating and distribution economies.

v v v

Two concerns have been recently acquired by H. K. Porter Co. Henry Disston & Sons, Inc. became a division of the company with the exchange of $6-million of its new preferred stock. At the same time, Carlson & Sullivan, Inc., a Monrovia, Calif. concern, also became a part of the new Henry Disston Div. of Porter.

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abstracts of FOREIGN LITERATURE

By M. Krezenberg
Consulting Engineer

Machining Copper Alloys

Comparatively little information is available on the machinability of copper alloys, possibly due to the fact that these metals are not as frequently used in workshops as steels and cast irons. Also, investigations of machinability of copper alloys are more difficult than those of other metals because of their tendency to stick to the tool. This subject is discussed by W. Matthey in the August 1955 issue of *Werkstattstechnik und Maschinenbau*.

The author divides the copper alloys into four groups of relative machinability. A table, published in the article, shows that there is a rather poor relationship between physical quantities and machinability. A trend may be recognized in that the author lists brass of more than 115 Brinell (hard and medium brass) among the copper alloys that machine best; soft brass of about 60 to 70 Brinell is listed among the metals with lowest machinability.

The four groups are also used for standardizing tool angles. Each group is broken down into three subdivisions of finishing light and medium cuts. In using the tool angle table it must be kept in mind that the concepts of positive and negative tool angles differ in Europe from American definitions.

Ten different quantities are cited by the author as affecting tool life. He supplements his discussion with tables for cutting speeds and feeds in machining brass of German Standard Ms 58.

Other topics discussed in the paper cover chip formation, surface finish, rigidity of barstock, shape of the workpiece, cams on automatics, coolants and cost comparisons.

Accuracy of Ball Bearings

Although general knowledge on the development of noise in antifriction bearings is still incomplete, it is recognized that one defective ball in a ball bearing has a great effect on the noise level and accuracy of such bearing. Considerable research in this direction

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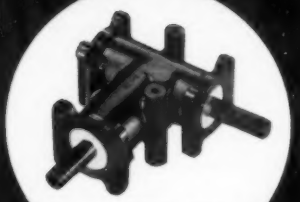

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has recently been carried out by A. Kohaut using an interference microscope. This work is described in an article in the October 1955 issue of *Werkstattstechnik und Maschinenbau.*

All balls of all bearings which he tested were checked by a method which the author has developed. He uses a ball turning device attached to the table of the microscope. With this the balls could be rotated about two axes which were perpendicular to each other. If the velocity of rotation about one axis is considerably less than that about the other axis, it is possible to observe the entire surface of the ball. Although the method is rather time consuming, it proved to be very accurate for finding defects in the balls.

The article is illustrated by numerous reproductions of interference diagrams taken through the microscope from which it is easy to see when a ball is perfect, when it has a flat spot, when it deviates from the geometrical sphere, when an indentation exists, etc. Secondary defects are caused by the assembly of the bearing. These include indentations, scratches due to a sharp particle and defects caused by the forced deformation of the cage when filling in the last ball.

In addition to common corrosion the author found also a new type of corrosion in ball bearings and assumed that it is of an electrolytic nature. His theory is supported by his findings where the corrosion had also developed at the contact circle on the races. Such corrosion is caused by fluids used in washing bearings; it is obvious that great care must be taken in cleaning and washing bearings in order to avoid corrosion. It is, however, not yet proved that corrosion has the same effect in generating vibration as a defective ball in the bearing.

Machine Tool Exhibition in Japan

W. Erdmann reports in the same issue of *Werkstattstechnik und Maschinenbau* on the machine tool exhibition held at Tokyo, Japan in 1955. The author indicates that about 1000 companies were represented; two thirds of them were Japanese; the others were American, German and other manufacturers. Import of foreign machine tools to Japan is permitted only of those types which are not built there.

Illustrations show that not much original development has been done; some of the machines were built under license agreement with foreign machine tool manufacturers. The exhibit covered all types of machine tools also including tracer controlled machines. However, most machines were for general machine shops rather than for mass production. The products of the

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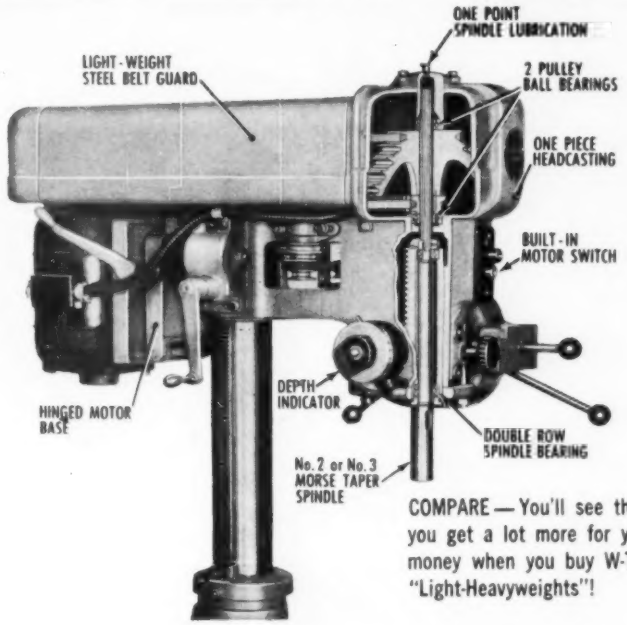

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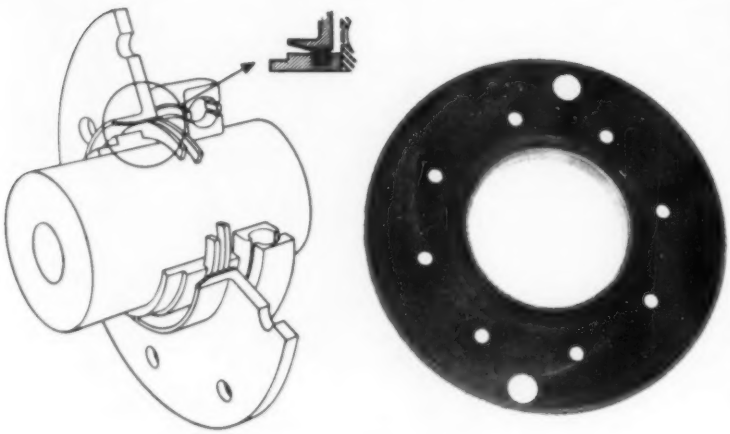

Flame-Plating solved the fretting corrosion problem which adversely affected the performance of the above turbine shaft seal.

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Ikegai Iron Works are worth mentioning because they have developed their own designs of lathes, among them a machine with hydraulic preselector for spindle speeds and an automatic copying lathe with tracer control at the front and a special cutoff slide at the rear.

Economical Cutting Speed

The most economical cutting speed depends on several factors, which have changed in different degrees during the past years. For this reason, K. Th. Preger in an article in the October 1955 issue of *Werkstatt und Betrieb*, wants to eliminate the cutting speed for 60 min. tool life which is often used as a reference. The author submits suggestions and indicates that tables and diagrams for machinability should be developed for shop use.

Grinding of Hobs

A thorough investigation of the mathematical relationships involved in the grinding of milling cutters and hobs has been carried out by G. Zeise. He reports his findings in the October 1955 issue of *Werkstatt und Betrieb*. The paper deals with the convex shape of the tool face, the helix angle, and with the "difference" angle which is the difference of the helix angle at the OD and ID of the hob.

Numerous diagrams are used to discuss details of the relationships which are of great significance in grinding hobs and accurate milling of gears. The profile of the grinding wheel is likewise taken into consideration and a new grinding attachment is discussed for a cutter grinder.

Leonard Electric Drive

Increasing use of the Leonard electric drive for machine tools is discussed in an article by M. Steinebrunner in the same issue of *Werkstatt und Betrieb* as the previous paper.

The speed range is considerably greater than that of an ac-dc motor generator combination, namely up to 20:1 as against 3:1. Another advantage of the Leonard drive is the safety against overloading of the gears in a machine tool in the lower speed range of the machine. The Leonard drive delivers a constant torque when running below a critical speed instead of a constant horsepower, which may permit making cuts that are too heavy for the drive gears.

The article is illustrated with diagrams and pictures of machine tools equipped with this drive. This was invented about thirty years ago but has been improved recently for the machine tool requirements.

good reading

ENGINEERING METALLURGY *by Dr. E. M. H. Lips. Distributed by Elsevier Press, Inc., 402 Lovett Blvd., Houston 6, Texas and/or 155 E. 82nd St., New York 28, N. Y. Price $6.25. 250 pages.*

For both the practical engineer and the metallurgist, this book brings the study of metals into direct relationship with present day manufacturing techniques.

The latest data concerning the various metals is so presented to enable engineers to easily find information to deal with specific situations. The book correlates engineering design and metals development to bring the latest metallurgical data under one cover.

HOW TO TRAIN ENGINEERS IN INDUSTRY. *Obtainable from the Professional Engineers Conference Board for Industry, 1121 Fifteenth St., N. W., Washington 5, D.C. Price $2.00. Approx. 82 pages.*

Facts in this book result from a comprehensive survey compiled by the Professional Engineers Conference Board for Industry with the cooperation of the National Society of Professional Engineers. The following phases of engineering are discussed: costs of training programs, typical training schools, training the trainers for a better job, and guidance toward professionalism.

THERMAL CONDUCTIVITY OF METALS AND ALLOYS AT LOW TEMPERATURES, NBS CIRCULAR *56. Available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Price $.50. 68 pages.*

This booklet was prepared by the NBS-AEC Cryogenics Laboratory of the NBS Boulder Laboratories to satisfy the need for a complete and authoritative compilation of the useful but widely scattered data on thermal conductivity at low temperatures. Included are tables of measured values of thermal conductivity for metals and alloys from room temperature down to approximately 0-deg K. Data are essentially complete for literature reference from 1900 to early 1954.

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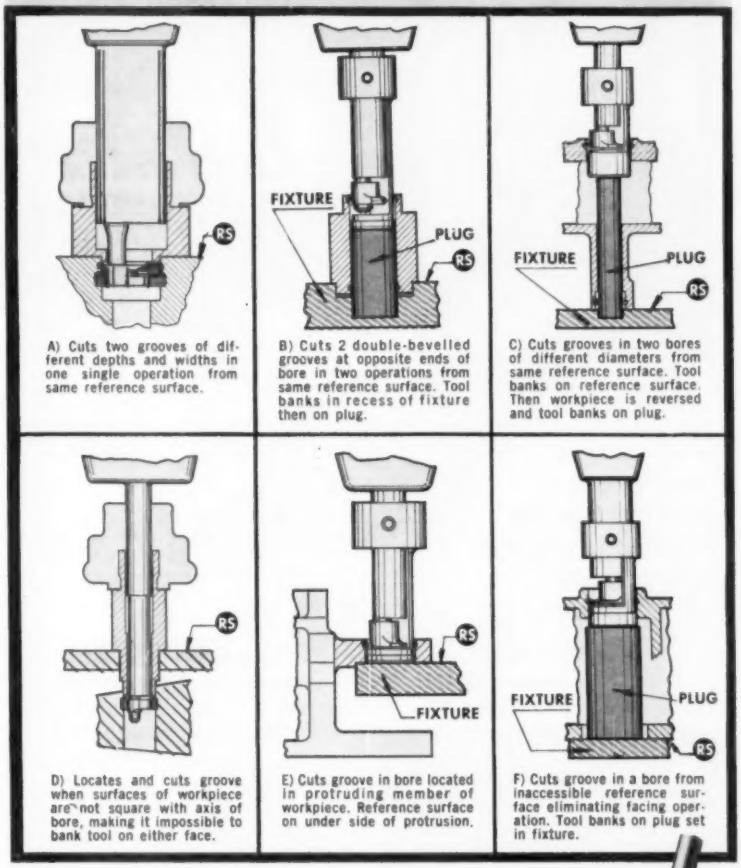

A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

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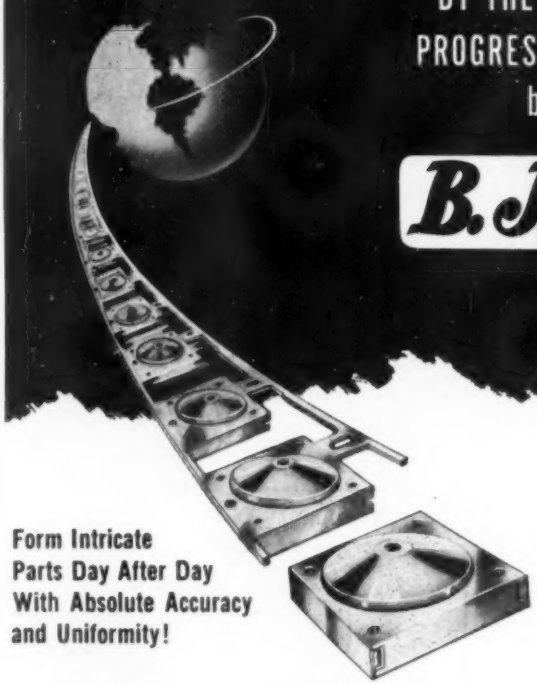

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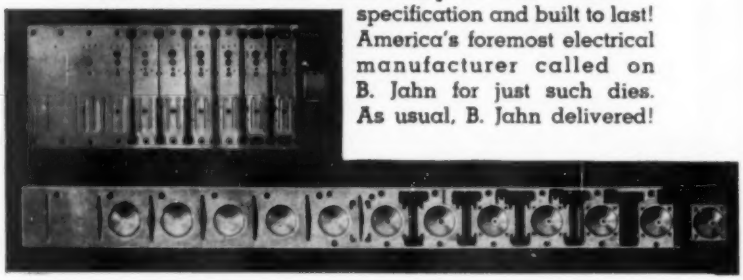

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SHELL MOLDING AND SHELL MOLD CASTINGS *by T. C. DuMond. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $2.00. 128 pages.*

The intention of the author was to present a complete and useful compilation on shell molding at a time when need for such information is greatest. The book provides material to permit potential users of shell mold castings to evaluate the method and to determine where and how the method could be used to advantage.

FUNDAMENTALS OF FRICTION AND LUBRICATION IN ENGINEERING. *Published by the American Society of Lubrication Engineers, 84 E. Randolph St., Chicago 1, Ill. Price $3.50; $3.00 ASLE members. 196 pages.*

Contained in this paper-bound book are 12 papers by world authorities in the field of lubrication.

Presented for the first time, the book gives detailed and illustrated discussions on such topics as: physics and chemistry of rubbing solids, mixed film lubrication, and hydrodynamically lubricated roll-neck bearings.

GOVERNMENT-OWNED INVENTIONS AVAILABLE FOR LICENSE, *PB11146. Published by U. S. Department of Commerce (Room 6227) Washington 25, D. C. Price $1.25. 55 pages.*

Described in this booklet are 657 government-owned inventions applicable to the metal processes and apparatus, machinery, and transportation equipment industry, covered by patents active as of December 31, 1953. Included for each invention are the title, patent number, inventor's name, government agency administering the patent, and an abstract of the patent. Evaluation of the invention with respect to its industrial application is facilitated by an examination of the technical data contained in the abstract.

FEEDBACK CONTROL SYSTEMS *by Gilbert Howard Fett. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. Price $10.00. 361 pages.*

This book is intended to serve the needs of engineers who want a basic understanding of feedback control systems and the tools and techniques required to solve the newer problems in this field. The book can also be used as a text for advanced engineering students.

Some less publicized methods of attack on the feedback control system are discussed. Problems of varying difficulty are provided at the end of each chapter.

THE NEW AMERICAN MACHINIST'S HANDBOOK. *Published by McGraw-Hill Book Co. Edited by Rupert LeGrand. Price $11.00. 1572 pages. Over 1000 illustrations.*

Based upon earlier editions of American Machinist's Handbook, the new handbook has been completely reorganized to quickly provide full, up-to-date answers to practical problems in metalworking. All the processes involved in manufacturing a metal product are covered in detail. Data on machining, metal forming, assembly, materials, metal finishing, inspection, fastening devices, tool engineering and drafting, machine tool standards, power transmission, plus mathematics and tables, are grouped for easy reference. Material is divided into eleven parts and subdivided into forty-five sections covering every major phase of machine-shop and drafting-room work.

EVERYTHING AND THE KITCHEN SINK. *Published by Farrar, Straus and Cudahy, Inc. Distributed by Philip Lesly Co., 100 W. Monroe St., Chicago 3, Ill. Price $4.00. 160 pages.*

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MATERIALS OR PRODUCT DEVELOPMENT. *Published by Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N. Y. Price $7.50. 160 pages.*

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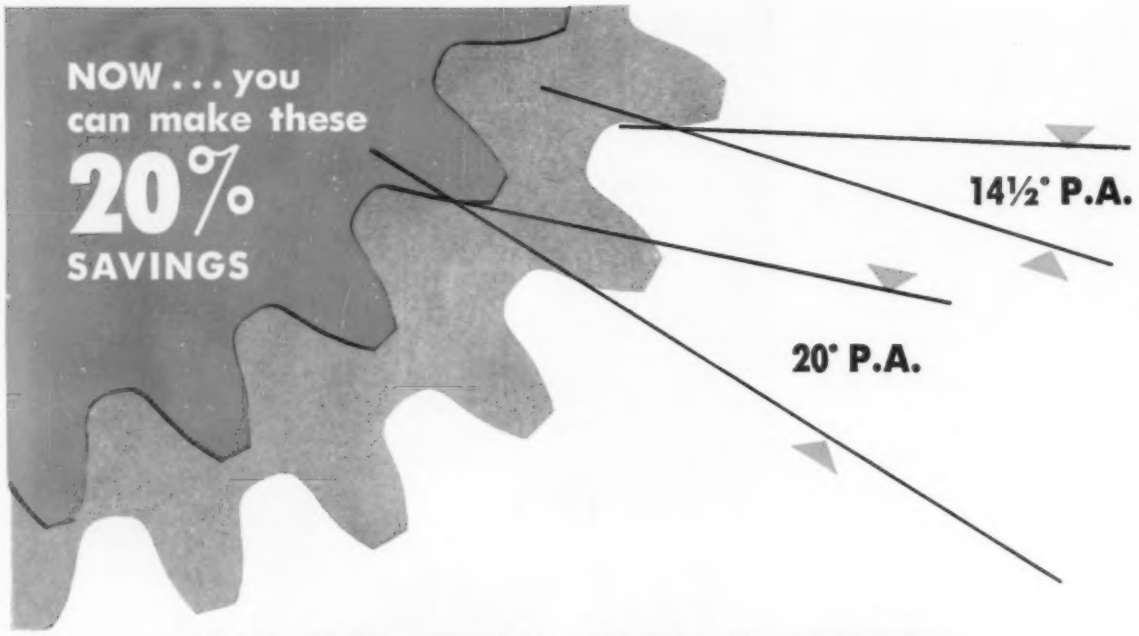

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technical digests

Automation in Gear Production

By M. R. Anderson
Executive Vice-President
Michigan Tool Co.
Detroit, Mich.

CONTINUOUS GEAR PRODUCTION, from blank to finished gear without intervention of human hands is now a reality. Devices incorporated in modern standard machines eliminate human errors in loading and inspection. The advantages of automation are that it cuts costs by providing more continuous operation, closer to 100 percent of rated machine capacity, than otherwise possible. Human handling of parts has been unable to keep up with basic capabilities of newer type machines without mechanical help. Thus, the full advantage of modern equipment is lost.

With automation, fewer operators can turn out more work with less effort and with a reduction in fatigue. This increases production per machine per man-hour. An example of a simple line-automation is shown in *Fig.* 1. This is a self-contained system for producing finished gears from screw machine blanks. Demand type handling distributes the parts to the machine tools and stores them between operations. Each machine tool loads up automatically and is automatically corrected to maintain correct part size.

This completely automatic system does not require interlocks, either electrical or mechanical, between the machine tools in the line or between the machine tools in the handling system. Each unit can operate at its optimum rate without being dependent on the balance of the line. Parts are fed directly and evenly to the machine tools without being delayed in dead storage. Excess parts are stored automatically on a first-in, first-out basis.

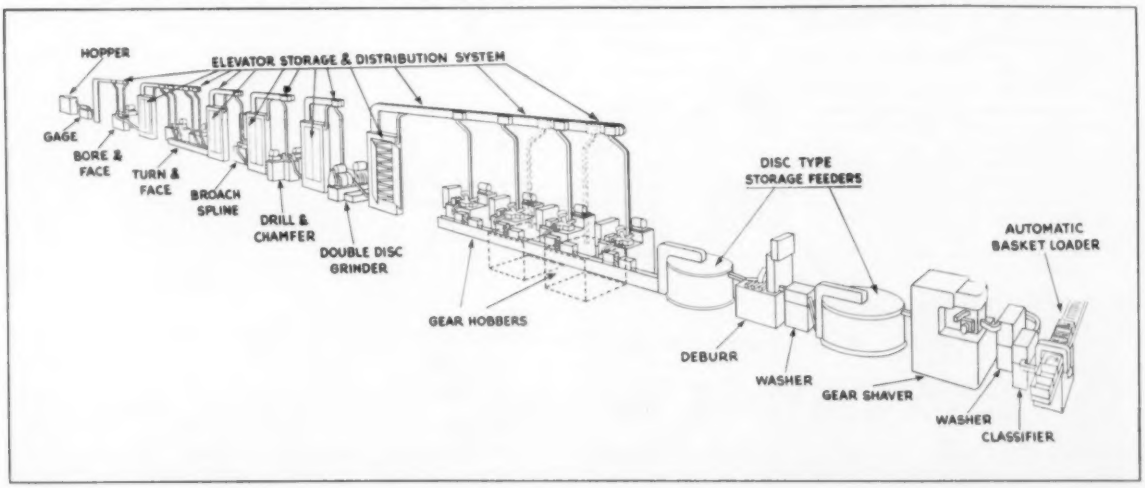
Distribution systems are overhead. Collection conveyors are near the floor. Floor space is minimized. Clear access is permitted to all sides of the machines.

Even salvageable rejects can be returned automatically to the machine for reprocessing. Heat treatment of gears can be integrated in the line. While this is a model, similar production lines will be turning out gears in automotive plants in the near future.

An actual line being designed for one major manufacturer will turn out about 800 automotive pinions per hour and will be 1200 feet long. Blanks are placed in a hopper at the beginning of the line. Next, a blank OD is ground, followed by a boring, facing and chamfering operation. Any undersized holes are honed in the next operation. They then pass to the finish face and chamfer operation, followed by automatic inspection. More hobbers and gear shaving machines are used on this line compared to the model, since more gears are to be produced. Each of the machines has the same automatic gear washing, sizing and classifying equipment, as in the model line.

An automatic basket loader ahead of the heat treat, places the green gears carefully in baskets that carry them through heat treat furnaces. After heat treat, baskets are emptied into an orienting hopper that starts them through the finishing operations. Next, gear teeth are chamfered. Hubs and oil groove are ground and the hole is honed. Gears are washed and sound tested in mesh with a master gear or gear speeders. Automatic gaging is the final operation. Then gears are routed to the automatic basket loader from which

Fig. 1. Perspective sketch of a model line for automatic production of gears from screw machine blanks.



they are taken to assembly.

Multiply a gear line such as this by the number of gears to be made for a high production geared assembly, such as in automatic transmissions, and the result is an automatic gear factory.

A photo of simple line-automation is shown in *Fig.* 2. Gear blanks go into the hopper in the foreground and come out as finished gears at the other end of the line. One operator can supervise the entire line.

There are also some disadvantages to automation, such as increasing machine cost. This calls for higher capital outlays. Further, specialized handling devices for a particular job tend to make the machine special, even though the basic machine is standard. Thus,

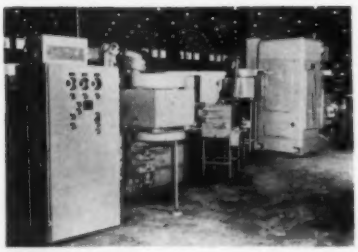


Fig. 2. Simple line-automation for production of automotive pinions from blank to finished green gear.

amortization must be absorbed per gear produced. In a completely automatic line, the cost of automation may equal or exceed the cost of the basic machine tools. Another disadvantage is that the automated machine is less versatile than the standard machine. More skilled maintenance personnel are usually required for servicing the equipment. This is brought about because the combined electrical motions and even hydraulics, are all in one package. Setting up of the machines become somewhat more difficult so this man requires special training. Thus, more specialists are needed for part of the work, and unskilled pushbutton operators for other jobs.

Many new problems have been involved in designing these automation lines. For instance, automatic inspection and control so that a machine can be stopped before it turns out too many defective gears. Another problem is that of correlating the supply of parts from various machines having different cycle times. A zig zag type conveyor, *Fig.* 3, functions as a storage cabinet. It need not be full of gears for the unit

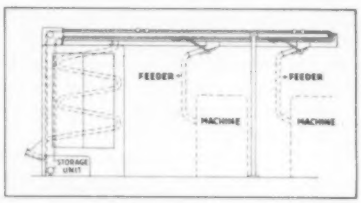


Fig. 3. Combination demand-type storage distribution system. Zig zag conveyor storage cabinet ahead of each operation, balances machine cycles.

to remain operative. A detail of the conveyor line linkage, particularly a gate that distributes gears as called for to the machine loaders, is shown in *Fig.* 4.

Looking ahead, tool life appears to be one of the limiting factors in automation and new studies must be made. Despite progress in controls, more and better warning signals, both electronic and optical, must be incorporated in future equipment. Probably more tape controls will be used for repetitive operations in various machines. Possibly a punch card system will be used, such as has proved successful in experiments on a number of other machines.

Automation will perform an additional important function in assuring control of analysis of steels for gear blanks. Poor steel, as evidenced by poor machineability, undue tool wear, or excessive distortion is spotted more readily

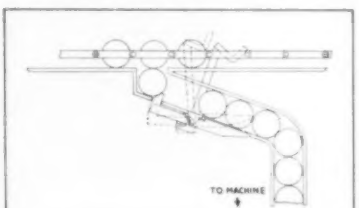


Fig. 4. Automatic demand-type drop gate. Release mechanism diverts parts from the overhead conveyor as they are called for by individual machines.

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through 100 percent checking and recording systems that follow each important operation in the automatic gear line.

Close tolerances become automatic when gears pass through inspection classifiers. With automation, more uniform gears with closer tolerances will be secured than was believed possible a few years ago.

From a paper presented before the 1955 Annual ASME Meeting. Nov. 14, Chicago, Ill.

▼ ▼ ▼

Producing Structural Parts of Brass Powder

By G. L. Werley

Research Staff
New Jersey Zinc Co.
Palmerton, Pa.

Increasing use is being made of brass-powder metallurgy in production of structural parts. For military production rotors for the safety mechanism of artillery ammunition fuses have been produced in quantities of more than 100 million. Many new ordnance parts are now specified for this type of production. For commercial production part of the shutter mechanism of a Polaroid Land camera is being produced of brass powder, namely, the tripper flywheel.

The process is relatively simple. The feed mechanism of the press is loaded with brass powder premixed with a lubricant, *Fig.* 1. The compression stroke of the upper punch compacts the

Fig. 1. Brass-power part loaded in die for compacting in 75-ton press.

powder, the green or unsintered compact is ejected by the lower punch. The compacts are racked as they come from the press and are loaded into a sintering furnace where they are subjected to temperature of about 1600 F. Production of 500 to 1000 pieces per hour are common in a single-punch press and, for parts of suitable design, multiple-punch rotary presses with speeds up to 6000 or more compacts per hour can be used.

Typical parts produced by this process are shown in *Fig.* 2. Most such parts are under 4 inches in diam size.

Fig. 2. Variety of parts produced of brass-powder.

One of the principal virtues of the process is that parts can be complex in shape, obviating the need for elaborate machining operations. There are, however, limitations imposed by both raw materials and fabricating equipment.

The types of parts well suited to brass-powder production include the following:

1. Cylindrical, rectangular or irregular shapes relatively thick (up to 1 inch) which, in general, do not involve large variations in cross-sectional dimensions and have a length to diam ratio not exceeding 2½ to 1.
2. Parts with surface indents or projections on top or bottom.
3. Parts with simple flanges or projections at one end.
4. Parts with splines, gear teeth or knurling.
5. Parts with holes, counterbores, slots or keyways.

It is good practice in designing brass-powder structural parts to avoid the following: narrow or deep splines, feather edges, sharp corners at the junction of the flange and body on flanged parts and other stepped designs. Normally, it is impractical to produce powder parts with undercuts such as annular grooves, screw threads, flanges at both ends, and the like, since, among other things, such parts are difficult to remove from the die. Machining operations, under-cutting, drilling and tapping, can easily be performed on brass-powder parts, particularly those which are formed with leaded brass.

Brass alloys compare favorably with other materials from the standpoint of solid density obtained with normal forming pressures. Powder parts are generally comparable in physical and mechanical properties to brass castings.

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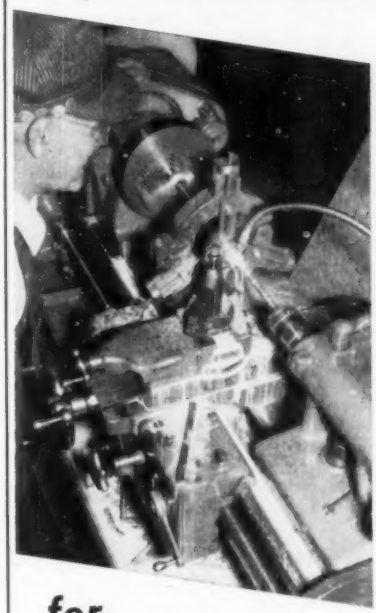

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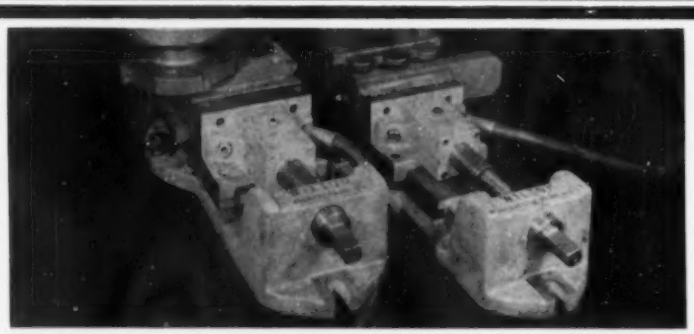

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technical digests

Properties of parts made from wrought brass may be approached by repressing. Many variations in mechanical properties can be obtained in compacts pressed from different powder compositions. Although intricate shapes require relatively complicated tooling, substantial savings over alternative methods result, because secondary operations are eliminated in many instances. Altogether, advantages can be summed up as: low unit cost, rapid production, close tolerances, fewer operations, low labor cost, low scrap loss and equal properties to brass parts produced by other small part fabricating methods.

From a paper No. 55-S-39 presented at the ASME metals engineering and machine design session, Baltimore, April 1955.

▼ ▼ ▼

Advances in Heat Processing

By R. C. LeMay

Selas Corp. of America
Philadelphia, Pa.

More precise automatic control of the shape of flames or of flame geometry is making the adaptation of heating processes to primary production lines increasingly practical. Product quality is thus improved, production costs are lowered and a contribution is made to the progress of automation in idustry.

Modern methods for controlling, accelerating and stabilizing combustion have made possible the determination of flame geometry to an extent that makes it a useful tool for industry. This is especially true with the recent emphasis on automation, the possibility of adequate control with high thermal heads, and of confining heat to a small and equal section of each successive part, Fig. 1.

Optimum application of flame geometry requires separate and adequate control of fuel composition, fuel-air ratio,

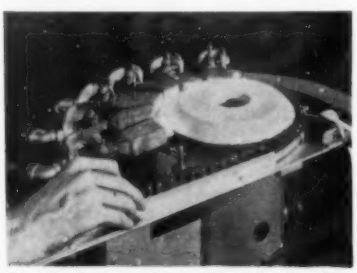

Fig. 1. Automatic machine for hardening heads of aircraft engine parts.

fuel-air mixture pressure at the burner, burner design, draft conditions, workpiece placement in relation to the burner and duration of exposure. Five general burner types, Fig. 2, have been held under the precise control required

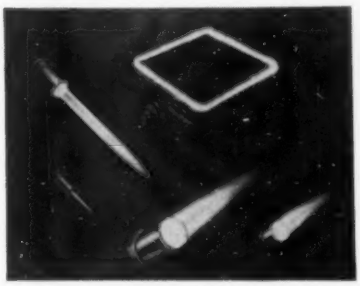

Fig. 2. Representative standard open type gas burners suitable for geometric flame control. Included are several spear or needle shapes as well as others designed with contours of specific work sections to be heated.

in automatic production. These are the ribbon burner, spear flame or needle burner, the round screen burner, radiant ceramic burner and the enclosed combustion burner.

With today's mass production techniques, it is assumed that in most production lines, workpieces are uniform. This is necessary before production line type heat treatment with high thermal head can be successfully applied. Modern automatic machines and feeding devices, however, have little difficulty in placing successive parts in the same position, with respect to burner location, or in maintaining equal exposure time for each piece, Fig. 3.

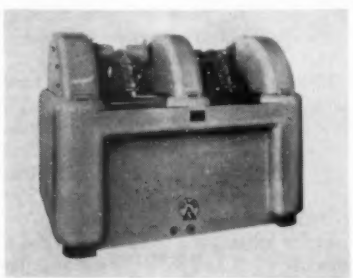

Fig. 3. Automatic heat-treating machine for hardening and tempering heads only of ball-peen and claw hammers.

Elimination of sharp drafts is also essential to accurately controlled open-flame heating. This pictures the application of enclosed combustion or superheat burners to the production line. The machine is for automatic heat treating and hardening heads of ball-peen and claw hammers. With only 350,000 Btu. 285 hammer heads are hardened and tempered per hour on the single machine fed by one operator.

These are only a few of the many new developments in industrial heat processing. Typically, additional controls are providing greater precision.

It is hoped the principles outlined, along with the applications illustrated will serve to aid and encourage production men to move necessary heat processes from remote locations into production lines. It may also encourage engineers working with liquid and solid fuels to develop burner types and applications over which there can be a higher degree of time and geometric control. In this way, flame geometry can become a more useful tool.

From a paper 55-SA-10 given at the ASME Semi-Annual Meeting, Boston, Mass., June, 1955.

▼ ▼ ▼

Mechanizing for Diversified Production

By B. D. Smith
Genl. Supervisor
Mechanical Engrg. Research
International Harvester Co.
Chicago, Ill.

Industry has many production processes of relatively lower requirements which are still being performed manually in batch-type operations. Some of these are laborious and monotonous. It is in this area that there is room for considerable improvement in machine tools and equipment. There are good reasons for this retarded advancement in mechanization, the principal one being the cost justification of mechanized equipment.

Low production is one of the prob-

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lems which must be met. Building versatility into the equipment helps do this. The large tolerances allowable in the manufacture of some parts is another problem.

In some instances, large varieties of parts in manufacture can be a hindrance to mechanization. Here the grouping of similar parts into families which can be processed over the same equipment is a good solution. Mechanized manufacture of similar parts belonging to one family can be accomplished by minor changes in tooling and setup.

In some cases parts are not readily adaptable to automatic manufacture owing to their peculiarity of design. Oftentimes under this condition it is wise to consider an entirely new method of manufacture, or a review of the design with product engineers to put the part into a class which is easily mechanized.

In planning the mechanization of an existing process or the installation of a new manufacturing technique, it is advisable to investigate standard machine tools and standard equipment which could be adapted advantageously.

Use of Special Equipment

If standard equipment will not satisfy the needs, machine-tool builders with related experience should be consulted and through cooperative effort, special equipment is designed to handle the job.

In the event standard equipment is not on the market and machine-tool builders with related experience are not available, designing and building special mechanization equipment should be performed internally.

With the advent of automation there is now a tendency in industry to sacrifice styling and place more emphasis on machine performance, work handling, safety and maintenance. Adherence to some JIC standards when purchasing equipment can enable a company to experience reductions in maintenance costs and in loss of production due to maintenance down time.

Other features to be desired in new equipment are automatic loading and unloading, automatic built-in inspection, and automatic controls. Automatic loading through hoppers or magazine feed mechanisms not only aids in producing parts of more uniform quality, but greatly relieves monotony among operators and enables them to concentrate their efforts on the workings and maintenance of the equipment.

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The value of tracer and cam controls has been recognized, but electronic controls are so much more versatile there can be little doubt that they will have a great effect on the automatic control of machine tools.

When technological improvements are incorporated in present manufacturing techniques, everyone will benefit from the results in higher living standards.

From a paper "Mechanizing Machine Tools for Diversified Production" presented at the ASME Machine Design Conference, April 6, 1955, New York, N. Y.

▼ ▼ ▼

Optimum Machine Loading

By Melvin E. Salveson
General Electric Co.
Schenectady, N. Y.

This study is concerned with problems of loading a fabrication center in a manufacturing plant in the GE company. A straightforward mathematical programming model which assumes linearity in the production rate and avoids setup by a priori deduction of estimated setup times provided answers to questions such as the following:

With assumed prices and costs, what is the optimum volume and mix of end products that can be supported by the parts production capacity of the machine center? Is there productive capacity in the machine center to support a particular volume and mix of end products? What is the maximum amount of one product that can be supported if output of two others are fixed?

An inverse procedure was used to determine what additional machine tools should be procured to support a specified volume of end products with minimum capital outlay. Further analysis demonstrated that the universally recognized economic lot size formulae are used only where inapplicable and are not useful where applicable. For this problem, it was found that the total first derivative of total cost for all parts with respect to cycle length was sufficient to minimize total cost.

From a paper given at the National Meeting of the Institute of Management Sciences, Oct. 20-21, 1955, New York, N. Y.

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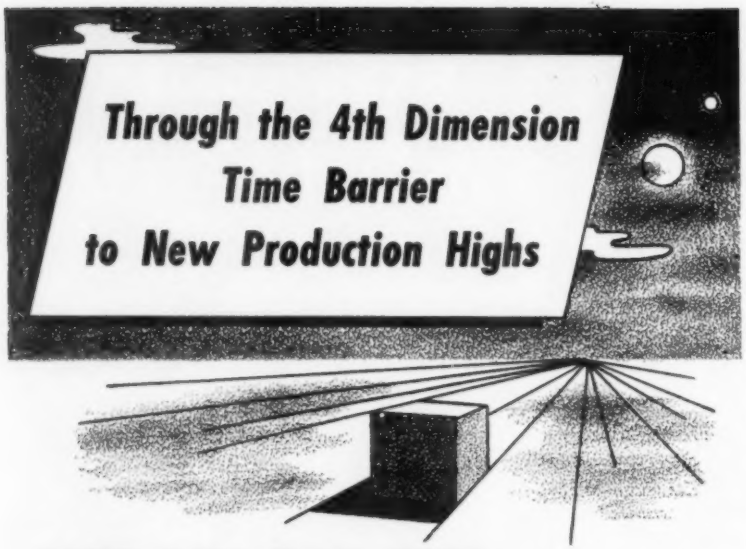

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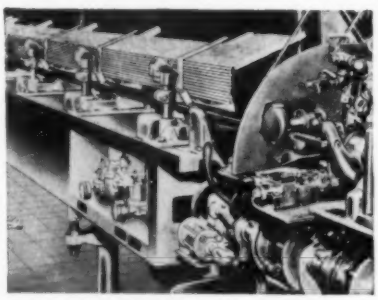

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Digital Control Systems for Production Processes

By Eldred C. Nelson
Ramo-Wooldridge Corp.

Automatic production equipment needs control to insure that variations in raw materials and environment can be overcome so that the product is uniform and production efficient. Control techniques in current use only partly meet these objectives. Digital control systems provide a new technique that has evolved from the development of electronic digital computers.

Initial applications to the control of military aircraft and associated weapons systems have in flight test confirmed predictions of unusual performance in difficult control situations. Studies of the application of this type of system to production processes lead to predictions that it will provide a means for approaching the control objectives of industry uniformity of product and efficiency of processes resulting in economic advantages of lower costs, higher profits, and improved competitive position can be anticipated.

From a paper given at the National Meeting of the Institute of Management Sciences, Oct. 20-21, 1955, New York, N. Y.

▼ ▼ ▼

Flash Welding Commercial Molybdenum

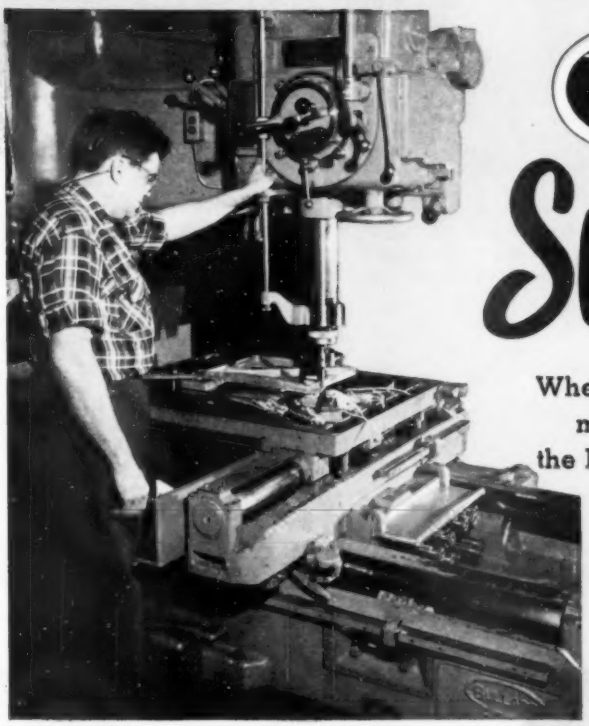
By Ernest F. Nippes
and
Winston Chang.
Rensselaer Polytechnic Institute, Troy, N. Y.

The bend ductility of arc-cast molybdenum flash welds depends on oxidation, weldment fibering, carbide precipitation, porosity, and grain-coarsening of the weld zone. Therefore, it is critically influenced by platen acceleration, amount of upset, and welding atmosphere. Under moderate amounts of upset and moderate platen acceleration, welds made in air exhibit acceptable ductility whereas the ductility of the welds made in argon or hydrogen is always low regardless of the upsetting conditions.

From a paper, "The Flash Welding of Commercial Molybdenum," presented at the AWS Annual Spring Meeting, June 7-10, 1955, Kansas City, Mo.

ACCURATE LOCATING PERFORMANCE

Acclaimed By Customer with . . .



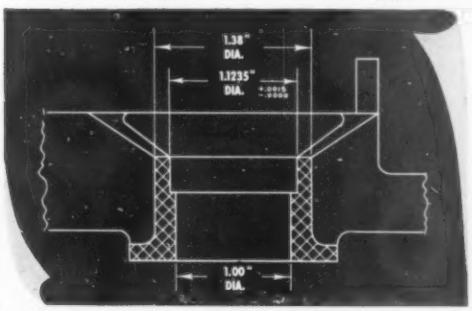
BULLARD Spacer Table

Where close tolerances must be maintained on repetitive pieces the Bullard Spacer Table is a "natural"

"The machine is simple to operate. We have found the Bullard Spacer Table very useful in our work", says a foreman at San Diego Division of Convair, "It eliminates the necessity of zeroing to a set position. And there is no chance for error, which is important when you make accurate parts for airplanes."

This same accuracy to close tolerances can be applied to your drilling, reaming or tapping operations without the high cost of jigs or fixtures.

Identical machining operations on each of three holes for battery carriage are performed on the Bullard Spacer Table.

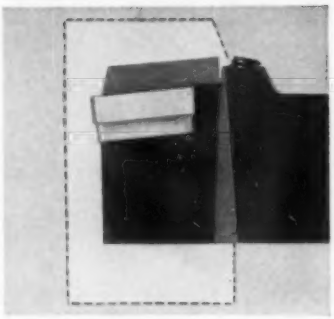


OPERATION DATA

OPERATION	SET-UP TIME	UNIT TIME
Drill 1" dia.	.70	.2066
Counterbore 1.1235" dia. at 1.000 dia. .350" deep	.25	.0566
Face 1.38" dia.	.25	.0356

CALL YOUR NEAREST BULLARD REPRESENTATIVE OR WRITE FOR SPACER TABLE CATALOG TO

THE **BULLARD** COMPANY
BRIDGEPORT 2, CONNECTICUT



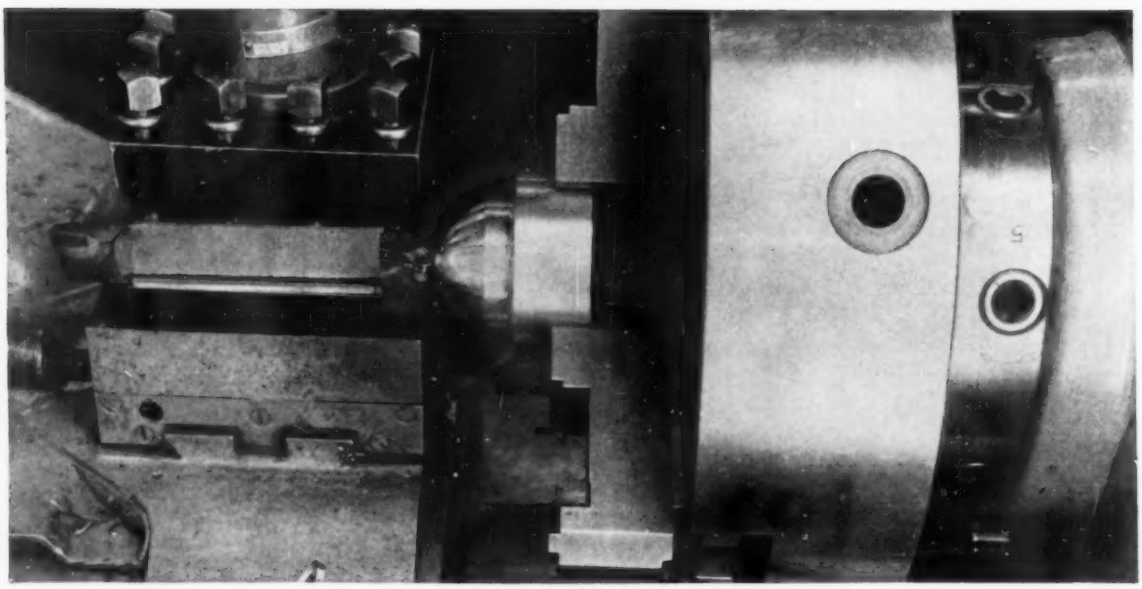
New design eliminates "club" below shank; reduces overhang to absolute minimum. Indexing is fast, simple . . . accuracy is increased.

Clamp has built-in, wear-resistant carbide chipbreaker. Requires only light finger pressure to tighten; assures uniform chips on any cut.

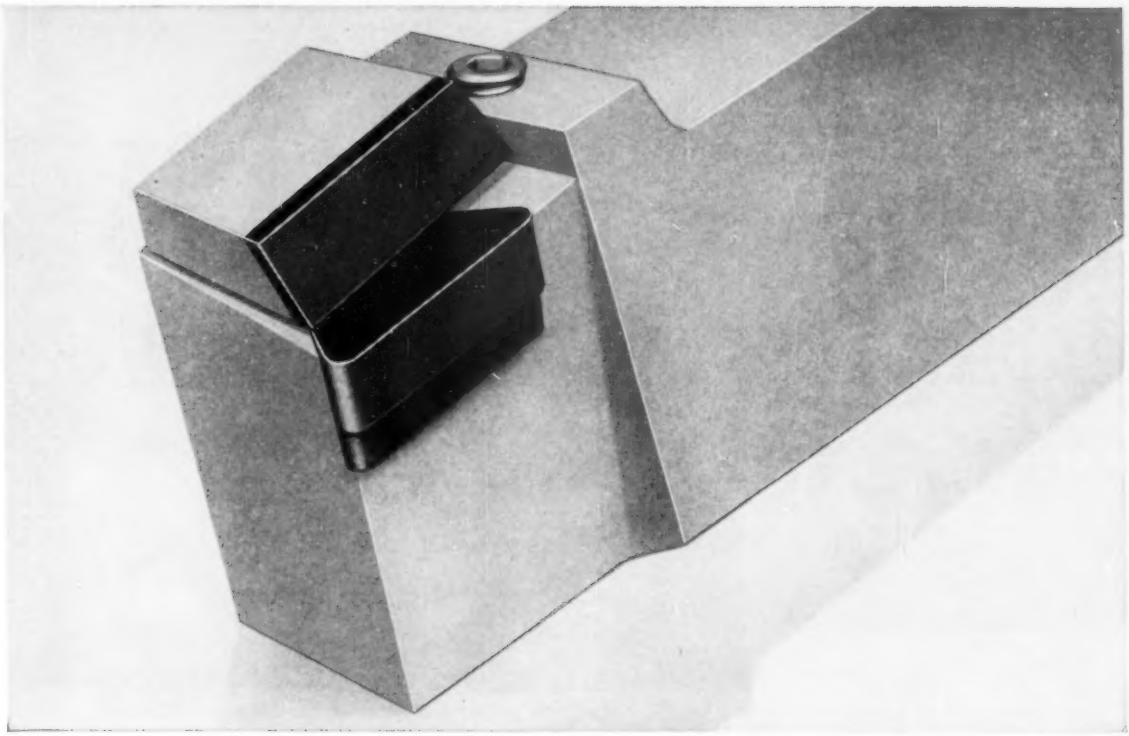
Indexable carbide pad is screwed to shank. Stays put while blank is indexed. Absorbs shock; decreases the possibility of holder damage.

Because they combine four
basic design improvements . . .

NEW CARBOLOY TOOLHOLDERS ARE EASIER



Contouring Stellite valve. Round Carboloy cemented carbide insert is furnished precision-ground, eliminating costly grinding operation required for braze-type tools. Inserts on new Carboloy toolholder are indexed or turned over right in the machine . . . reducing downtime. With Carboloy holders, only inserts are stocked . . . saving valuable toolroom space.



TO USE . . . STRONG, SIMPLE, AND ACCURATE

- **Single screw indexes insert; automatically sets chipbreaker**
- **Carbide pad absorbs shocks; cuts throw-away insert costs**
- **New design reduces overhang; improves tool accuracy**
- **Heat-treated shanks resist bending and deformation**

Simply adjust a single screw at the top of the shank, and the cutting blank can be indexed or turned over while the Carboloy holder stays in the machine. The carbide chipbreaker is set automatically in the correct position.

Carbide pad cuts insert costs

Because the carbide pad absorbs shocks and gives greater rigidity, thinner, harder, more economical cutting blanks can be used. Machines operate at greater speeds and feeds; increase output at reduced cost.

Carboloy design eliminates projections below the shank . . . reduces overhang, increases accuracy and rigidity. Minimum projection above the shank stops chip interference, protects clamp from abrasive chips.

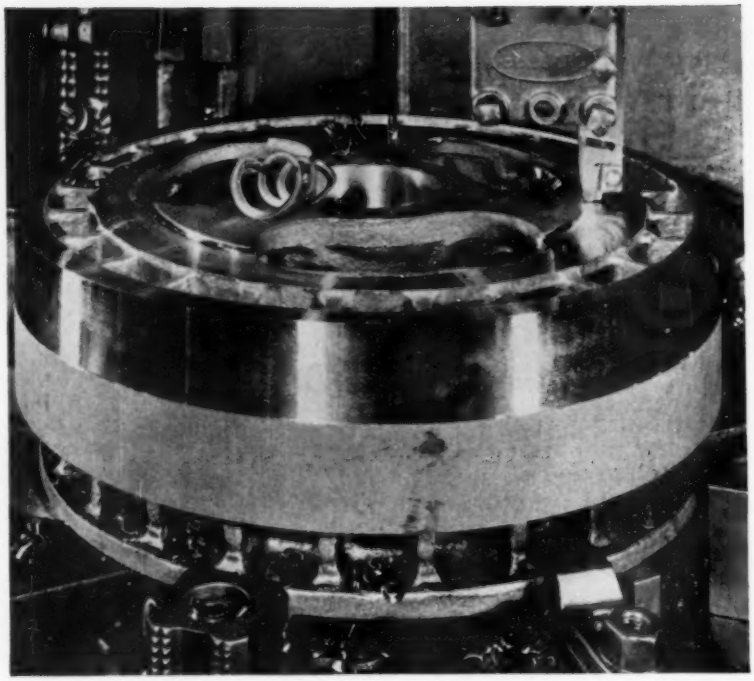
Heat-treated shanks give the holders extra strength to resist clamp-screw deformation and chip wear.

Handle special jobs with ease

The Carboloy holder design is quickly adaptable to "specials" with cutting angles other than standard, and to positive or neutral rakes. New, compact design makes them especially efficient for gang tooling.

Available for round, square, or triangular blanks, the Carboloy holders are stocked in seven styles and 52 sizes. New, heavy-duty holders are also available. For prices and specifications, send in the coupon on page 4 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

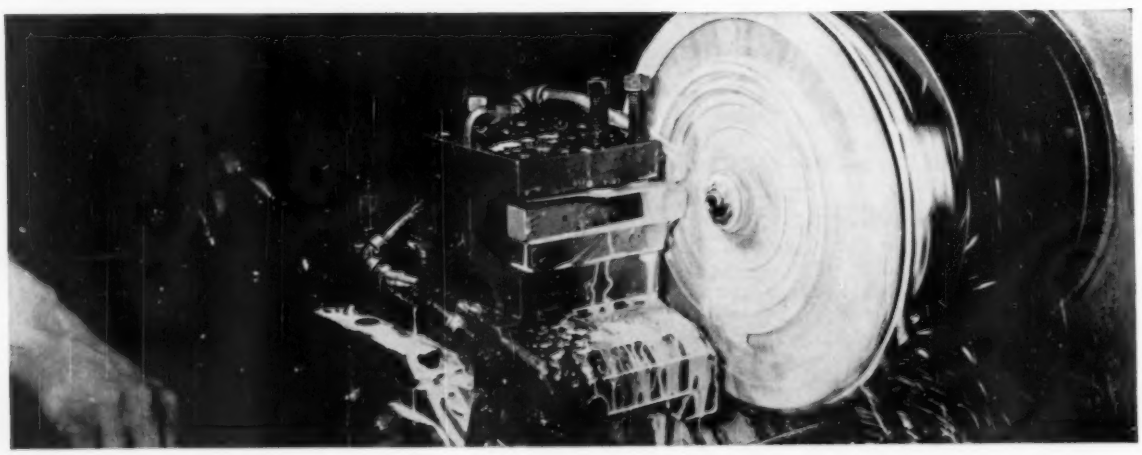


FACING POWER-SHOVEL CLUTCH AND BRAKE DRUM. It took as many as 16 of the former carbide tools, on a 42-inch Bullard, to make a *single* cut through multiple sand inclusions and heavy interruptions. A Grade 370 tool took *nine* cuts without any appreciable wear. Because the Grade 370 tool outlasted 144 of the previous tools, over-all machining costs were cut almost 70%, downtime costs were reduced from $60 to $1, and grinding was completely eliminated.

SETUP: Material—1045 low carbon, high manganese cast steel, with hardness of 27 R_c. **Speed** – 24 RPM. **Feed** – 0.018-0.033 inch. **Depth of cut** – ⅜ inch. **Coolant** – No.

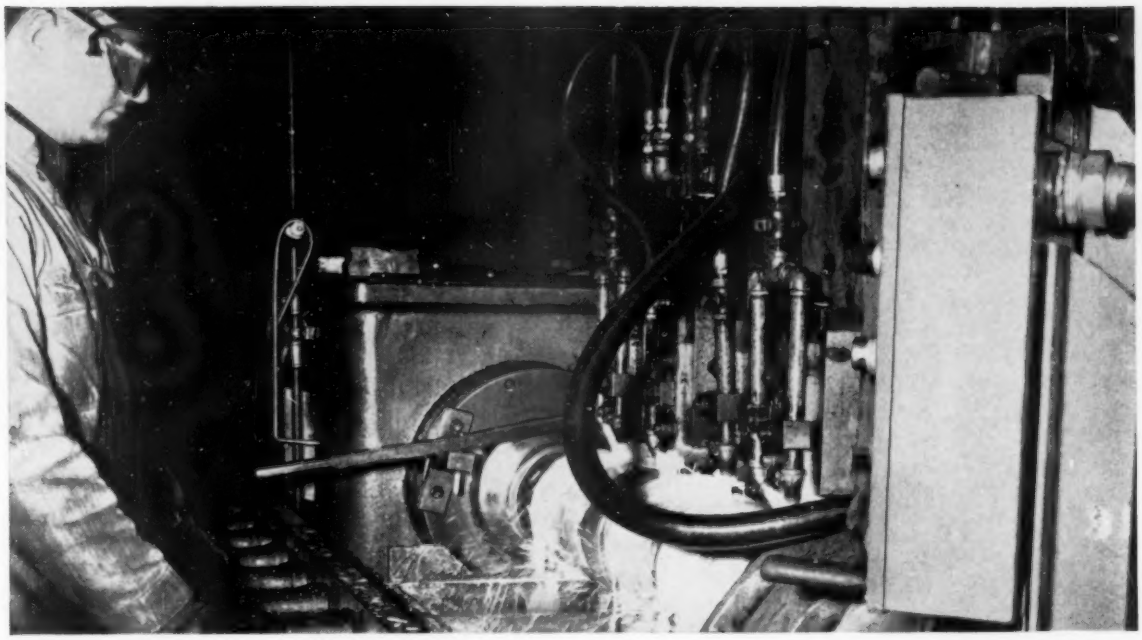
Hundreds of in-plant case histories prove . . .

CARBOLOY GRADES 350 AND 370 CUT FASTER,



FACING TURBINE WHEEL BUCKET. It took 60 carbide tools, making two separate cuts, to get daily production of 25 units at Kelsey-Hayes Wheel Co. By switching to Grade 370, the two-cut operation was compressed into one, the number of tools required was reduced two thirds, and production was almost doubled.

SETUP: Material – Inconel, heat-treated to 18 R_c, welded to rim of Stellite. **Speed** – 125 sfpm. **Feed** – 0.0155 inch. **Depth of cut** – ⅜ inch. **Coolant** – Yes.



TURNING 8-INCH STEEL SHELL. Grade 350 increased production runs on these forged and extruded shells between 15 and 20 pieces per grind. At toughest stage of rough-turning operation, Grade 350 processed 4 times as many shells as other carbides.

SETUP: Material – 1045 steel with varying heat analysis. **Speed** – 302 sfpm. **Feed** – 0.044 inch. **Depth of cut** – 3/16 to 7/16 inch. **Coolant** – No.

WEAR LONGER, GREATLY INCREASE OUTPUT

▸ **Outperform all other steel-cutting carbides**

▸ **Take heavier, deeper cuts without deformation**

The machining records in plant after plant show Carboloy Grades 350 and 370 are capable of increasing output up to 300% over previous carbides used.

Not only do these grades outperform conventional carbides at higher speeds and feeds, but they outwear them on the toughest jobs – in some instances by margins as high as 144 to 1. (See case history above at left.)

Built-in structural rigidity

Carboloy Grades 350 and 370 are extra-performance carbides. Their superiority is due to the greater structural rigidity built-in by the Carboloy manufacturing process.

This process enables them to take deep, punishing cuts without the chipping, cracking, or cratering encountered in other carbides . . . even at temperatures as high as 1800° F.

No "equivalent grades"

Try heavy-duty Grade 370 and medium-duty Grade 350 in your own plant . . . compare them with regular tools on your toughest jobs. You'll quickly see why there are no "equivalent grades" to Carboloy 350 and 370.

Your local Authorized Carboloy Distributor stocks a complete line of Grade 350 and 370 tools, blanks, and inserts. Contact him today. Or for more information on these extra-performance Carboloy steel-cutting carbides, send the coupon below.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11101 E. 8 Mile Blvd., Detroit 32, Michigan

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Send me information on:

☐ Grades 350 and 370 steel-cutting carbides

☐ Carboloy Toolholders

Name_____

Company_____ Title_____

Address_____

City_____ Zone_____ State_____

Tough grinding jobs?

Check Vulcanaire high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Vertical adaptor for Surface Grinders. Grinding small slots

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Horizontal application. Grinding a shoulder Punch.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

Major Vulcan Services

Engineering, Processing, Designing and Building... Special Tools... Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. . . . Vulcanaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

VULCAN TOOL CO.

7300 LORAIN AVENUE • DAYTON 10, OHIO

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Easy TO MAKE TAPPING AND REAMING SET-UPS

With the Ziegler Tool Holder you can make tapping and reaming set-ups in a fraction of the time required by ordinary tool holders because, with the Ziegler, the set-up does not have to be so accurately made.

Just align the work within 1/32" of center on the radius (1/16" on the diameter) and the Ziegler automatically corrects the inaccuracy.

Try this easier, faster, and better way of making set-ups. You'll be surprised at the time you'll save.

PROMPT DELIVERY

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Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

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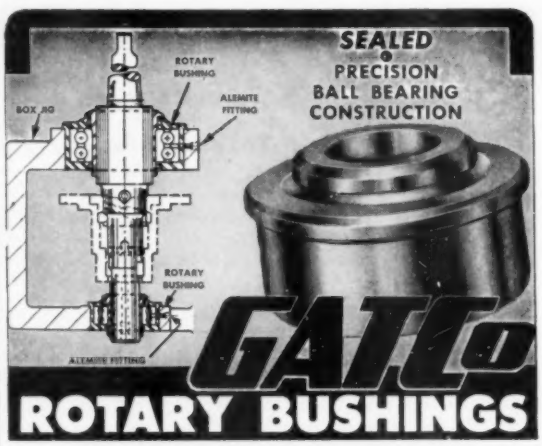

ROTARY BUSHINGS

FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

GATCO ROTARY BUSHING CO.

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Telephone PLYMOUTH 1472

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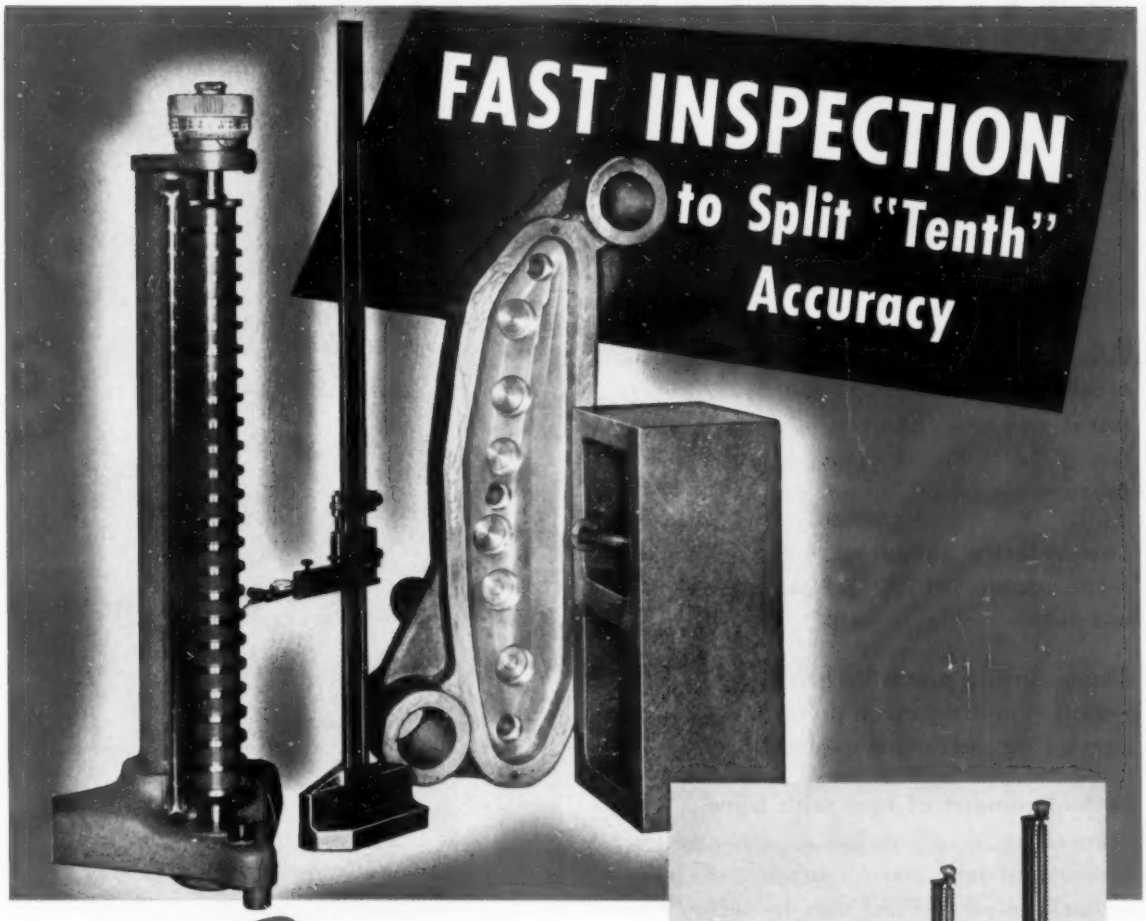
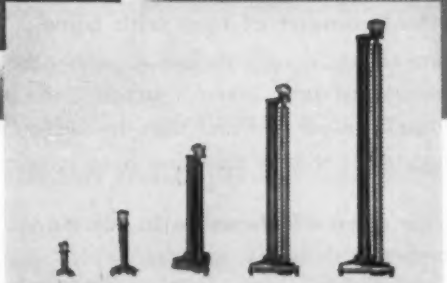


Cadillac PLA-CHEK

Height gage and micrometer settings are 5 to 20 times faster with Cadillac PLA-CHEK than with other methods of comparable accuracy. Less than 15 seconds establishes *any* dimension within a 24″ range to limits of less than .0001″. No auxiliary gage blocks necessary—PLA-CHEK is totally self-contained. Dimensions are taken from the surface plate or from a base line on the work. Send coupon TODAY for complete details!



Cadillac PLA-CHEK Gages are available in a complete range of sizes from the easily portable 6″ and 12″ models for smaller jobs, to 24″, 36″ and 48″ models for larger inspections. Precision-made risers may be used with PLA-CHEK Gages —increasing the range of each 6″ to 12″.

MAIL THIS COUPON FOR COMPLETE DATA

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P. O. BOX 3806, DETROIT 5, MICHIGAN
Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Cadillac
GAGE COMPANY
P. O. BOX 3806 • DETROIT 5, MICHIGAN

MICROHONING*

PRECISION

in millionths of an inch

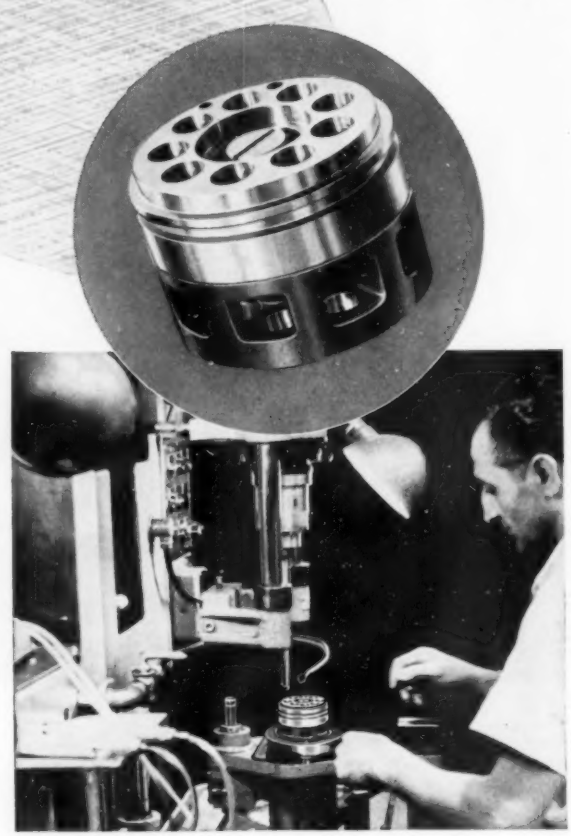
MICROHONING is inherently the most accurate of all production methods used for stock removal. Four major characteristics make Microhoning the controlled abrading process—that produces precision in every part.

Low velocity abrading technique
—low speeds (50-250 SFPM) minimize heat and surface stresses.

Sharp cutting abrasive grits at all times
—the self-dressing action provides clean, constant cutting and uniform surface finish.

Self-alignment of tool with bore
—use of the "float" principle . . . either the tool or workpart has universal action . . . automatically aligns tool and bore to correct bore inaccuracies without changing bore location.

Large area of abrasive in constant contact with work surface
—cutting pressure is evenly distributed over the surface by the thousands of minute abrasive grits collectively removing substantial amounts of stock. There is no localized heat to damage the surface or sub-structure of the metal.



An aircraft hydraulic pump block component, made up of cast iron and hardened steel (58-60 Rockwell "C"); nine ported cylinder bores are Microhoned to obtain surfaces which will maintain a "running" seal and which will not gall or "pick-up." From .006" to .008" stock is removed from each bore while holding these tolerances:

geometry—.000025"
diameter—.000050"

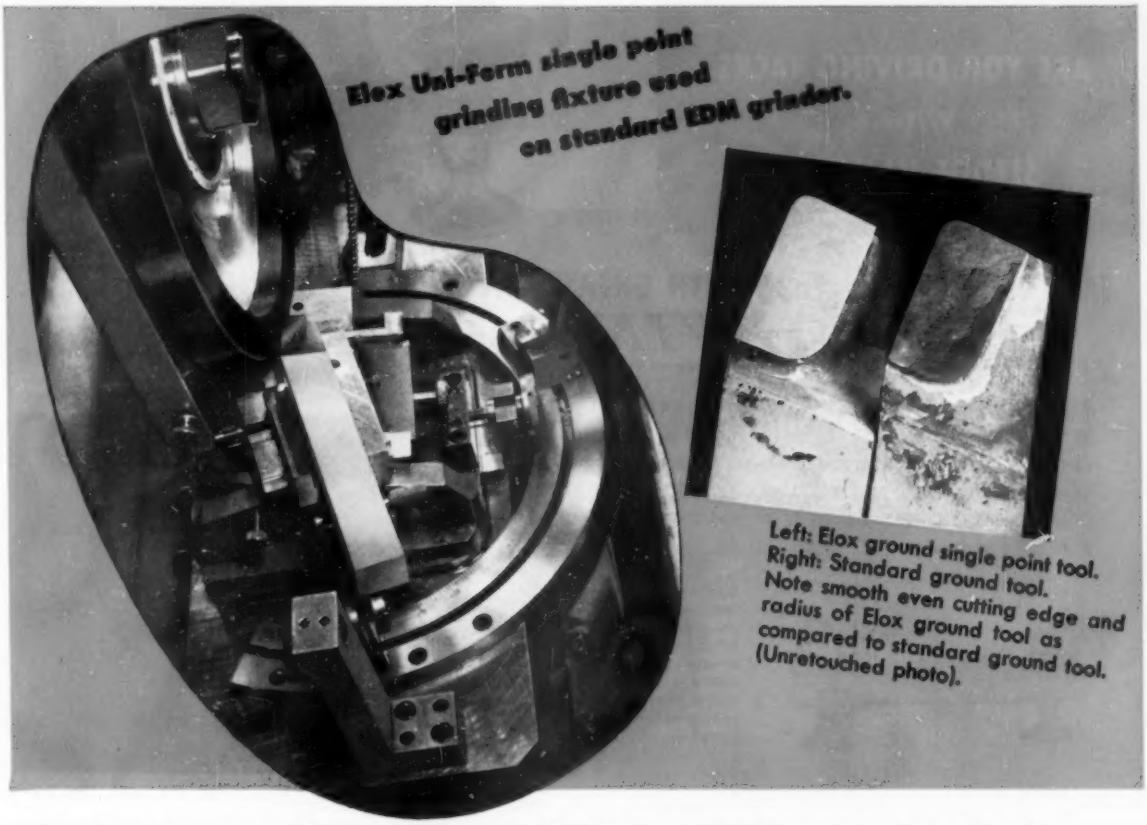
Steel surface finish is held under 8 microinches; cast iron, under 10 microinches. Bores of both sections are Microhoned in line in the same operation.

For a more complete story on this application, write for CROSS-HATCH, Vol. 7 No. 4.

*MICROHONING = Stock Removal + Geometry + Size Control + Surface Finish

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN


Elox Uni-Form single point
grinding fixture used
on standard EDM grinder.
Left: Elox ground single point tool.
Right: Standard ground tool.
Note smooth even cutting edge and
radius of Elox ground tool as
compared to standard ground tool.
(Unretouched photo).

grind 2 faces and radius on 1/2" x 1" carbide insert in 3-1/2 minutes automatically . . . repetitively . . . without variation . . . without heat checks . . . without manual assistance!

elox* *corporation of michigan*

1837 Stevenson Hwy.
Royal Oak 3, Mich.

DEMONSTRATION CENTERS:
Plant—Royal, Mich.

45 Broad Ave., Palisades Park, N.J.
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Elox Electrical Discharge Machining of single point tools is an electronically controlled push button operation. Variable human elements are completely eliminated, guaranteeing every tool sharpened identical as to finish, radius. Grinding is done with a brass wheel to any pre-determined specifications. Every tool repetitively uniform!

Advantages of Elox Uni-Form Tool Grinding:

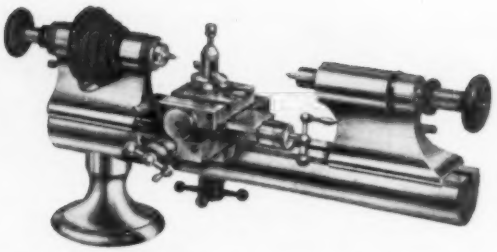
- **Permits use of standard blanks**
- **Every tool is identical as to radius, finish**
- **Increased tool life**
- **More regrinds per tool**
- **Eliminates diamond wheels**
- **Carbide and tool shank are ground simultaneously**
- **Averages 40% labor savings**

See Elox Uni-Form Single Point Tool Fixture in operation at Elox Demonstration Centers.

Elox Electron Drill equipment for removing broken taps, drills, etc., from $495 to $3450.

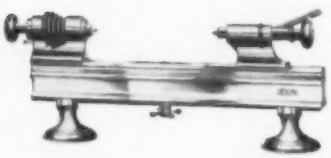
*T.M. Reg.

ARE YOU DRIVING TACKS
WITH A
SLEDGE HAMMER?

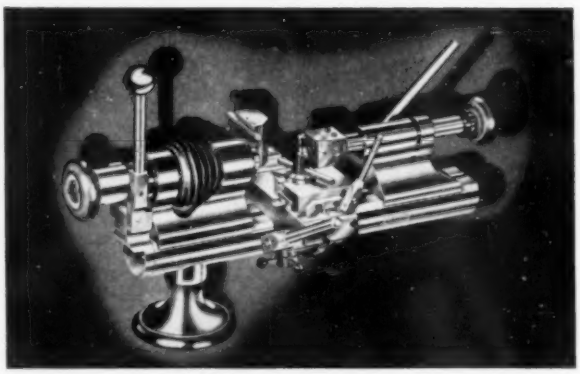


SMALL PARTS ARE MADE WITH GREATER ACCURACY • ECONOMY • SPEED
ON *LEVIN* INSTRUMENT LATHES

For efficiency small work should be done on a small lathe. In many cases the work done on an instrument lathe requires a degree of precision and fine finish which cannot be obtained from larger machines. LEVIN lathes are made in two collet capacities, 5/16" or 3/16", and thirty-three different models.



Send for Catalog M describing complete line of instrument lathes and accessories. Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.



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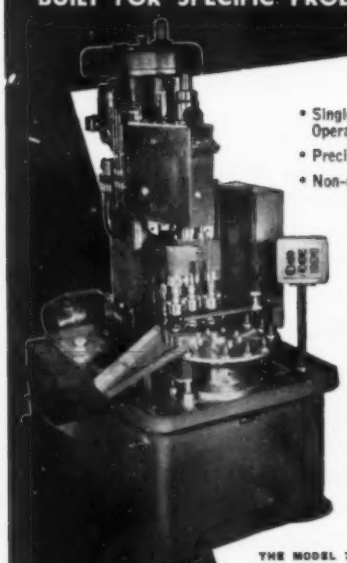
KAUFMAN
TAPPING MACHINES
BUILT FOR SPECIFIC PRODUCTION JOBS



- Single or Multiple Head Operation
- Precision Depth Control
- Non-reversing Motor Drives
- Pressure Lubricated Lead Screws
- Fast, Accurate Rugged Index
- Other Head Units Available
- And Many Other Worthwhile Features

Send prints and sample of your work for further information and recommendations on how Kaufman Tapping Machines can reduce your production costs.

THE MODEL 75-24 KAUFMAN TAPPER

Catalogs Number 754 and 1153 Mailed on request

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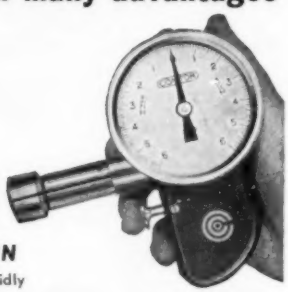

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COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

UNIQUE ADVANTAGES
- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
- Indicates actual size, a fixed—not passing—reading.
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- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Gages work while still held in chuck.
- A shop tool for all-day every day use.
- Portable—no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, automotive transmission, household appliance, farm machinery, guided missile and other volume-precision plants. IT MAKES PRECISION GAGING EASY . . . at machine . . . at inspection bench . . . for selective assembly. No other like it—investigate and see why.

COMTOR COMPANY
69 Farwell St.
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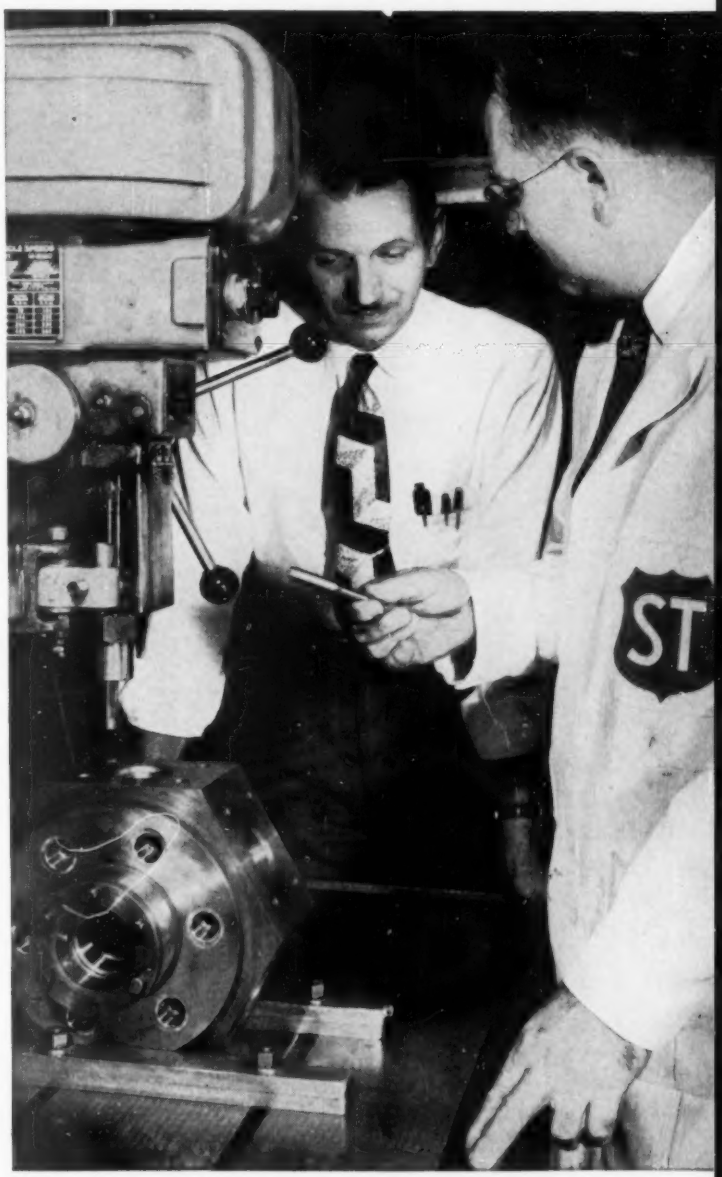
STANDARD TOOL

....serving Industry since 1881



● The Standard Tool Man, Serving Industry Since 1881, can recommend the correct tap, grind and speed that will enable you to reduce your production costs. Find out how his broad experience on metal cutting can help you. The Standard Tool Man is always at your service without obligation.

Call him!

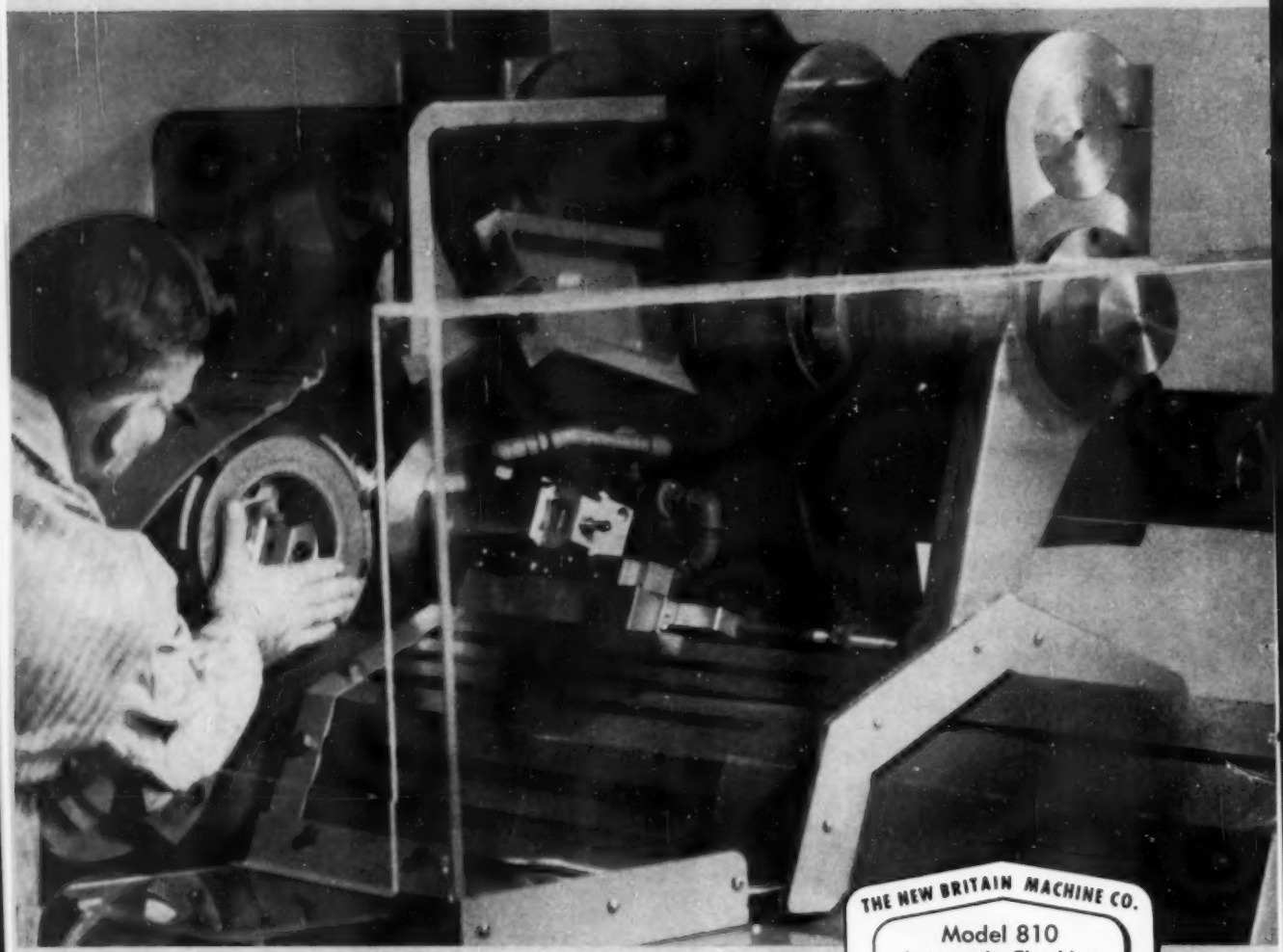
Complete line . . . stocked by the Standard Tool Distributor in your area

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

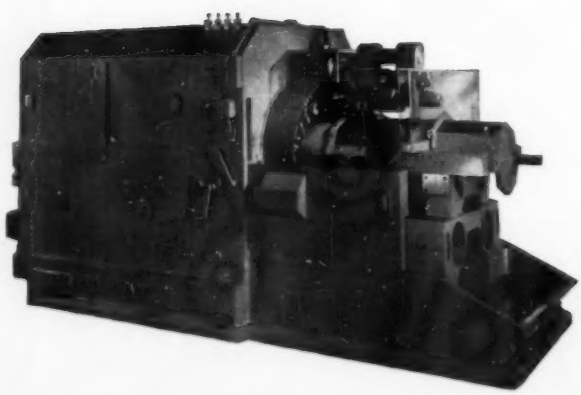
FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide-Tipped Tools · Gages*



size no object

All the advantages of New Britain four, six and eight spindle chuckers now can be applied to your *big* castings and forgings. Chucking capacity to 15 inches, open-end construction, double indexing for work on both ends and automatic loading where practical, mean more pieces per hour and lower cost per piece. The New Britain Machine Company, New Britain-Gridley Division, New Britain, Connecticut.



At Wendel Research & Mfg. Corp.

Shell Dromus Oil E increases tool life 60%, provides better cooling and increased production

Wendel Research & Mfg. Corp., Albertson, New York, encountered extremely short tool life when drilling A.I.S.I. 4140 steel used in the manufacture of pilot ejection seats. They also experienced broken bits, chip welding, discoloration and burning of the tools. Shell Dromus Oil E was recommended to combat these difficulties. Here are the results:

Dromus Oil E immediately ended Wendel's trouble. The drill and steel bar stock were very cool and easy to handle. Chip settling was excellent, and discoloration of tools and work was completely eliminated.

Here are some of the outstanding features of Dromus Oil E:

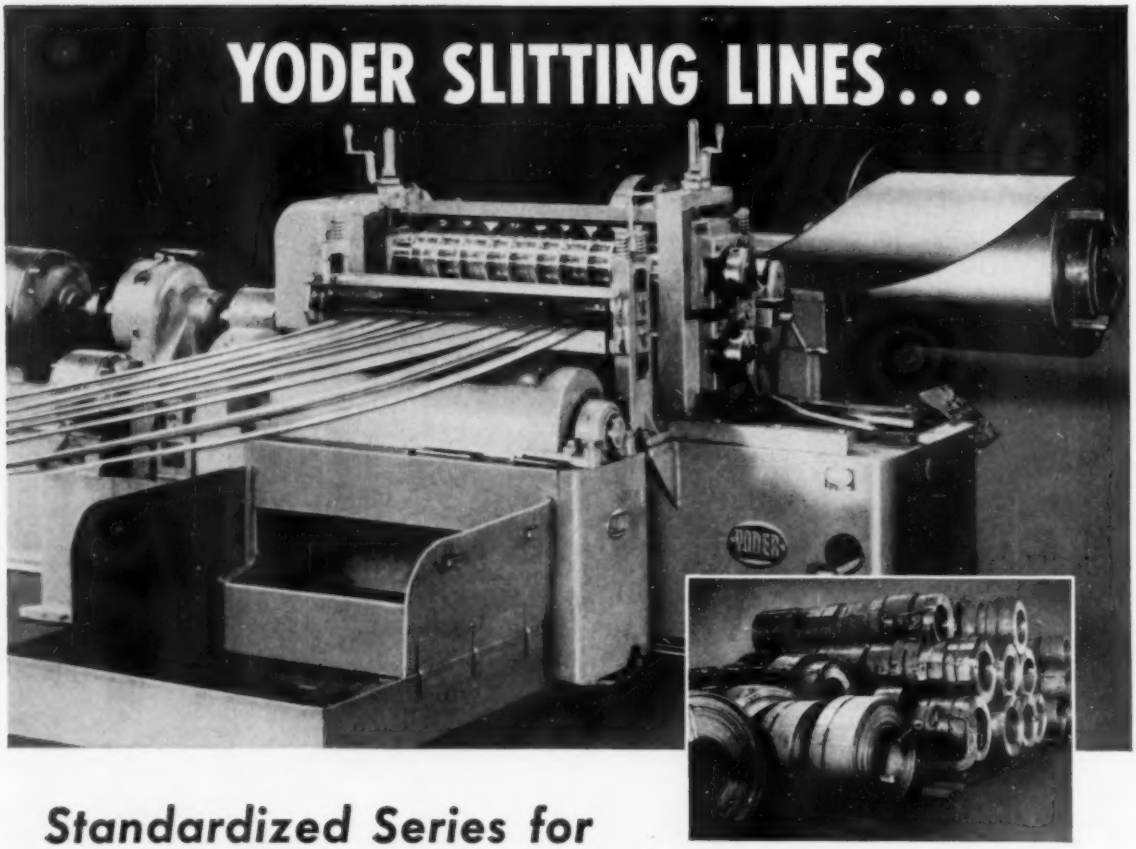
1. Excellent wetting and cooling properties—wets all metal surfaces extremely fast.
2. Provides longer tool life—better finish.
3. Not sticky or greasy—keeps tools and work exceptionally cool.
4. Forms a solution, not an emulsion . . . is stable in any concentration.
5. Easy to mix in hot or cold, hard or soft water.

Write for information on Shell Dromus Oil E. See how it can help you increase tool life.

SHELL OIL COMPANY
50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

YODER SLITTING LINES...



Standardized Series for
LOW FIRST COST AND OPERATING COST!

A relatively small, low-cost Yoder slitting line offers attractive savings possibilities and high production in slitting small and medium coil sizes and strip gauges. Yoder has standardized a series of such machines, affording a rare combination of low cost and productive capacity amply sufficient for the needs of the great majority of sheet metal fabricators and custom slitting shops. Supplementing the standardized series are *special models for slitting big coils and heavy gauges at high speeds.*

For requirements as low as 100 tons per month, one of the standardized Yoder slitting lines will pay for itself in short order. The savings PER TON increase rapidly with decrease in coil size and width of strands to be slit.

Another important advantage gained by fabricators having their own slitter is the ability, from a relatively small stock of standard width coils, to meet expected and unexpected needs for slit strands in a few hours. This means easier production planning and greatly reduced strip inventories, in addition to lower prices and quicker deliveries of their strip purchases.

Yoder Slitter Book contains basic information on the economics and mechanics of slitter operation, with time and cost studies, production records and other valuable data. Send for it.

THE YODER COMPANY • 5525 Walworth Ave. • Cleveland 2, Ohio

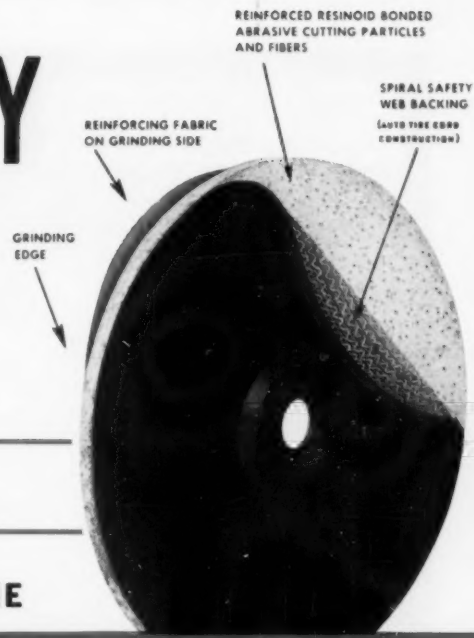
ENGINEERING YODER MANUFACTURING

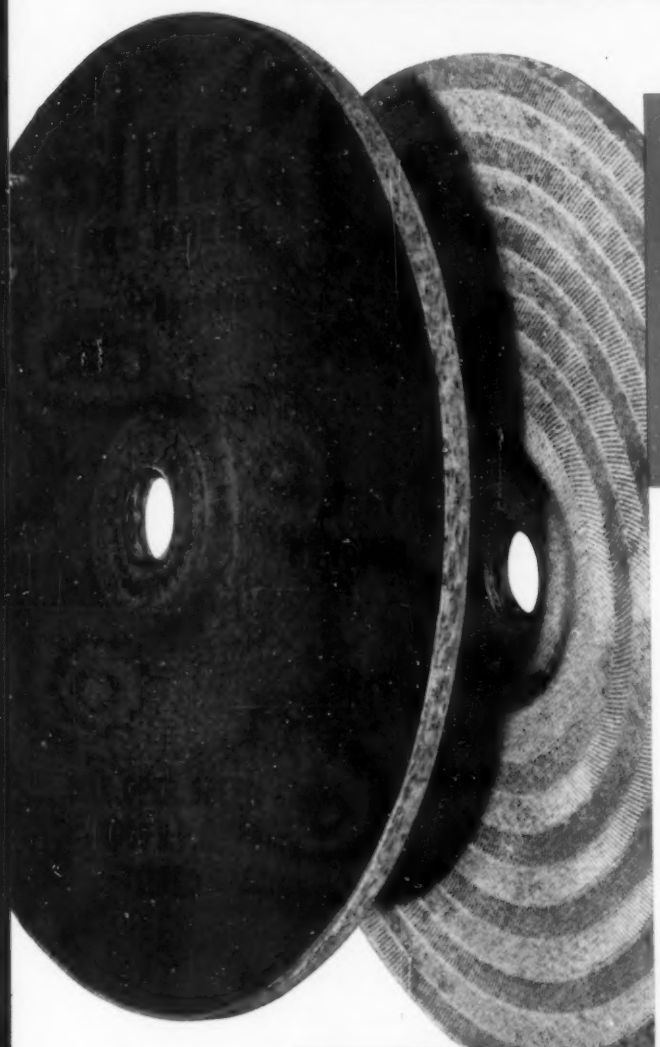
ROTARY SLITTING LINES
COLD ROLL FORMING MACHINES
ELECTRIC-WELD PIPE AND TUBE MILLS

STRUCTURALLY DIFFERENT...

FOR EXTRA STRENGTH

EXTRA SAFETY


REINFORCED RESINOID BONDED ABRASIVE CUTTING PARTICLES AND FIBERS
SPIRAL SAFETY WEB BACKING
(AUTO TIRE CORD CONSTRUCTION)
REINFORCING FABRIC ON GRINDING SIDE
GRINDING EDGE



IT'S THE

new

SIMEX®

RED WHEEL

SIMONDS ABRASIVE CO.

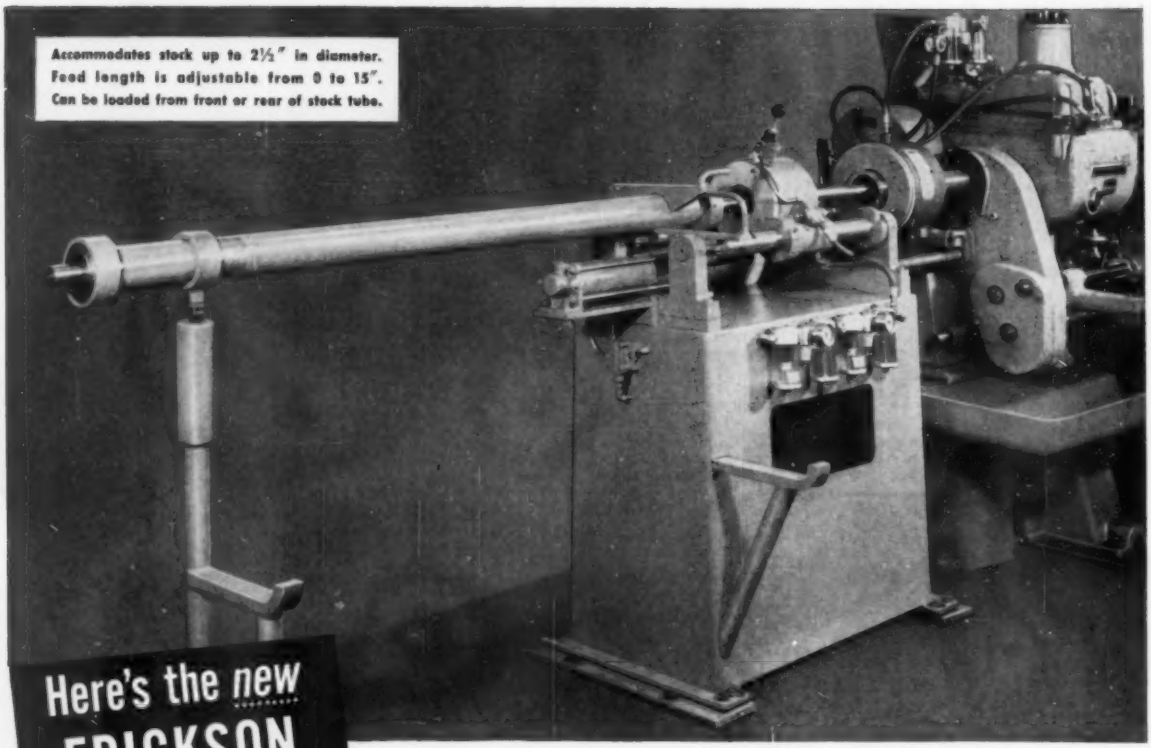
For rough, tough production grinding—welds, removing flash and bead; cleaning up rough ragged surfaces and edges. This new lightweight rigid type reinforced resinoid bonded abrasive wheel can give you sensational savings. Use Simex on portable disc type and right angle type portable grinders. Depressed center or raised hub shape; 7″ and 9″ diameter x 3/16″ and 1/4″ thickness.

SEND FOR BULLETIN ESA-244 AND LEARN HOW MUCH BETTER SIMEX IS FOR YOUR JOB

Extra Savings FROM YOUR SIMONDS DISTRIBUTOR'S STOCK • SERVICE • KNOW-HOW

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco. Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass.


Accommodates stock up to 2½" in diameter.
Feed length is adjustable from 0 to 15".
Can be loaded from front or rear of stock tube.

Here's the *new* ERICKSON PNEUMATIC BAR FEED!

...An Automatic Air Stock Feed and Collet Operating Unit Designed to Operate with any Collet Equipment

• *Increases production* • *Reduces operator fatigue*

THIS NEW ERICKSON Stock Feed automatically feeds bar, hex or tubing stock to your machine tools for rotating or non-rotating machining operations. It is an air-powered, fully automatic unit which is quiet, simple to operate, safe to use, rugged and dependable. It can be used with any type of collet equipment.

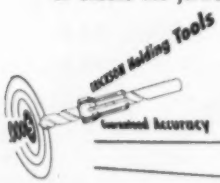
EASE OF OPERATION reduces operator fatigue and speeds set-up cycle time. One valve controls entire operation. At a flick of the valve handle, spindle collet opens and feed chuck advances stock to preset length; feed chuck then opens its jaws. Another flick closes spindle collet on stock and returns feed chuck to its starting position where it closes its jaws on stock to give double grip.

AA-976

OPERATIONAL ADVANTAGES

- Assures positive movement of stock. No dragback of stock on return stroke.
- Adjustable feed chuck jaw pressure eliminates marring or crushing of stock while providing positive grip.
- Permits use of exact size, polished stock.
- Provides double grip on stock to resist "pushback".
- Stock feed is adjustable to suit cycle time and bar size.
- Stock moves with spindle rotating to reduce cycle time.
- No safety controls needed due to basic design.
- Filler tube is supported over its length by ball bearings in stock tube. It rotates with stock to prevent marring, eliminate chatter.
- Rugged welded base construction rigidly supports feed chuck, dampens vibration, reduces whip, guaranteeing smoother finishes, quiet operation.

For complete information on the new Erickson Pneumatic Bar Feed, send for your copy of Circular K-2 today!



ERICKSON TOOL COMPANY

2303-1 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

Why limit yourself to "STOCK" sizes?

Hannifin can ship the cylinder you need within 48 hours!

(NEW AND EXPANDED PRODUCTION FACILITIES MAKE THIS POSSIBLE)

Any mounting style in:

Series "A" Square Head Air Cylinders—1½" to 14" bore
Series "H" Square Head Hydraulic Cylinders—1½" to 8" bore
Series "LW" Cast Head Air Cylinders—1" to 12" bore

Strokes
As specified to 60"

Rod Ends
Catalog standards, including standard alternates.
Most special rod ends require only 24 hours longer.

Cushions
Either or both ends if required

Quantity
Normally any quantity you need for rush jobs.
For large quantities specify your requirements.

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When the need is urgent
call long distance.
Experienced sales engineers
will handle your order

CALL HANNIFIN CYLINDER SALES
Des Plaines Number—VAnderbilt 4-0151
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Do you have these two newest Hannifin catalogs?

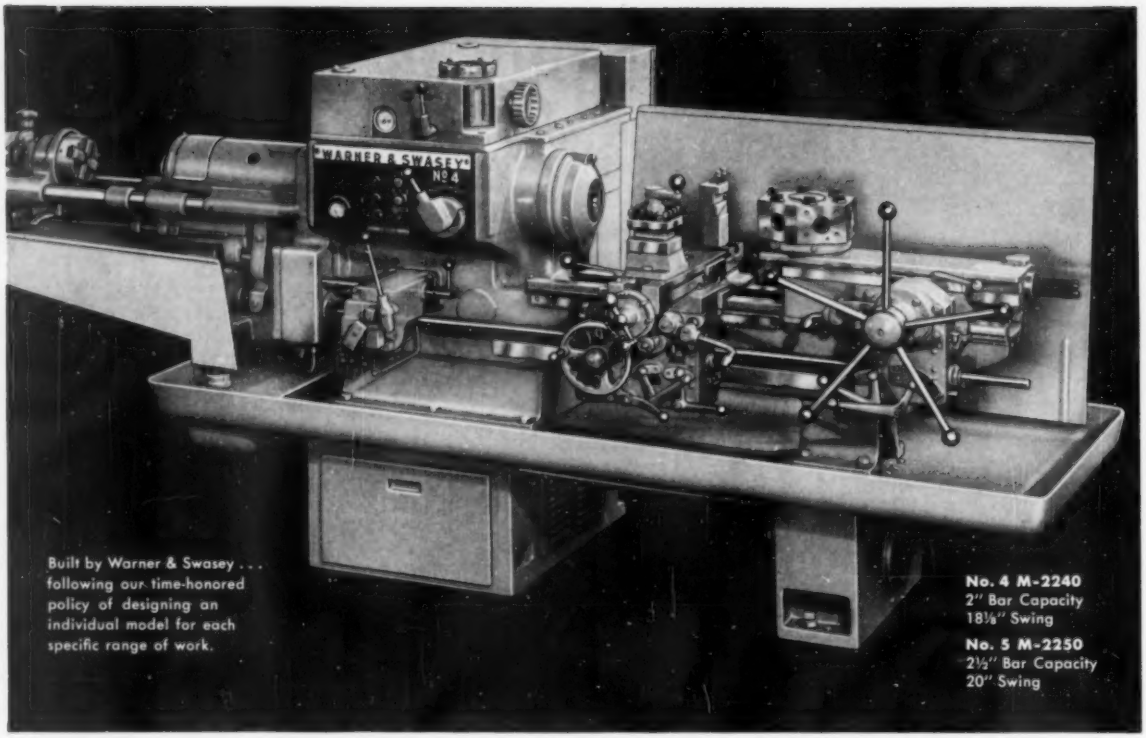
BULLETIN 113—
Series "H"
Hydraulic Cylinders

BULLETIN 213—
Series "A"
Air Power Cylinders

Write for your copies

HANNIFIN

Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Ill.
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves



Built by Warner & Swasey . . . following our time-honored policy of designing an individual model for each specific range of work.

No. 4 M-2240
2" Bar Capacity
18⅛" Swing

No. 5 M-2250
2½" Bar Capacity
20" Swing

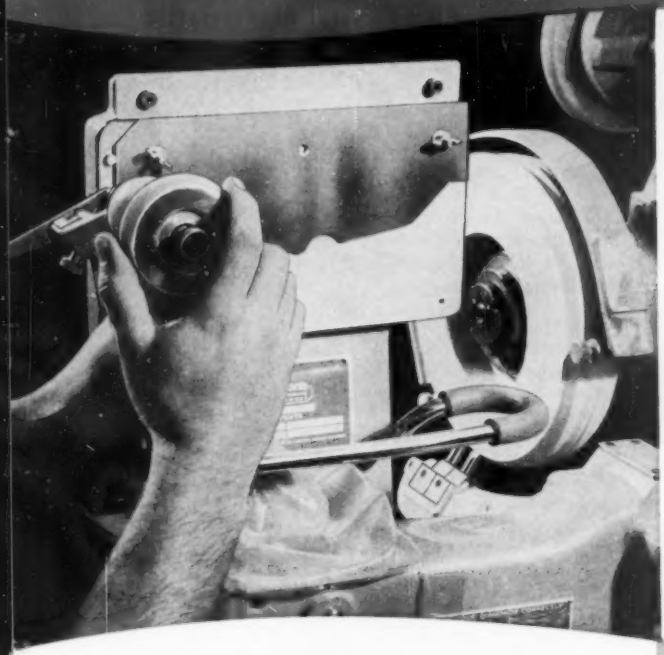
WARNER & SWASEY introduces NEW No. 4 and No. 5 RAM TYPE TURRET LATHES

- Higher Speeds
- Instantaneous speed changes—sliding gears eliminated
- Direct-acting hydraulic clutches—need no adjustment
- Smooth, quiet running, helical high-speed gears
- Short, stubby shafts—anti-friction bearings throughout
- Single lever control for forward, reverse, brake and free spindle
- One lever control for speed changes and 6:1 ratio high-low shift
- Two-speed motor provides 24 *unduplicated* speeds, forward and reverse, with a 62.5 to 1 over-all range
- Flange-mounted, direct-drive motors—no belts
- Patented direct-reading speed preselector—calibrated in rpm's, surface speed and work diameter
- Rigid, heavy-duty, high speed hydraulic bar feed with adjustable feed-out
- Single lever control for hydraulic collet chuck and bar feed
- Zoned operating controls for effortless machine operation
- One-piece head and bed for greatest possible accuracy
- Larger, separate oil sump provides cooler filtered oil
- Retains Warner & Swasey standard tooling interchangeable with your present models

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

FORM-TRUE GRINDING WHEELS



with

PRATT & WHITNEY

Diaform

WHEEL FORMING ATTACHMENTS

FORM COMPLEX PROFILES
TO "TENTHS" ACCURACY
. . . in minutes

there's a P&W Diaform **RIGHT** for Your work!

Team up a lightweight, portable P&W DIAFORM Wheel Forming Attachment with your horizontal spindle surface grinder and true those complex grinding wheel shapes in minutes . . . re-truing the same shapes as often as required . . . produce ***better*** dies, punches, forming tools etc. ***in hours instead of days!***

Operation . . . based on the pantograph principle . . . is very simple, requires no special skill. A tracer is lightly traversed over an inexpensive template; reduction ratios of 10:1 or 5:1 minimize template errors and the form is diamond-trued at the wheel to tenths of a thousandth accuracy.

- **SMALL** — **MODELS AT and BT**
  for truing wheels up to 10" diameter and 1" wide.
- **MEDIUM** — **MODELS 2A and 2B**
  for truing wheels up to 14" diameter and 2" wide.
- **LARGE** — **MODELS 4A and 4B**
  for truing wheels up to 20" diameter and 3" wide.
- **RELIEF GRINDING** — **SERIES "R"**
  eliminates lengthy calculations and trial-and-error methods . . . accurately compensates for rake or relief angles on form cutting tools and provides true form at the cutting edge. Three models accommodate wheels up to 20" diameter and 3" width.

PRATT & WHITNEY FACTORY-DIRECT SERVICE

The Pratt & Whitney Representative who calls on you is a Specialist in his line. He's fully qualified by training in our factory and by long experience to bring you the expert application engineering service essential to full productive efficiency.

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16 CHARTER OAK BLVD., WEST HARTFORD, CONN.

Branch Offices . . . BIRMINGHAM • BOSTON • CHICAGO CINCINNATI • CLEVELAND • DALLAS (Southwest Industrial Sales Co.) DETROIT • HOUSTON (Tri-Tex Machine & Tool Co.) • LOS ANGELES NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS . . . Export Dept., WEST HARTFORD

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PRATT & WHITNEY COMPANY, INCORPORATED
16 CHARTER OAK BLVD., WEST HARTFORD 1, CONN.

Please mail my free copies of:

- ☐ Bulletin No. 543-2, Diaform Models AT and BT.
- ☐ Bulletin No. 572-1, Diaform Models 2A and 2B.
- ☐ Bulletin No. 548-1, Diaform Models 4A and 4B.
- ☐ Bulletin No. 574, Series "R" Diaform.

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NEW!

Em-re
PRECISION
DIAL INDICATORS
THE MOST ACCURATE MADE

Some time ago, we recognized the need for a dial indicator with greater accuracy . . . So, using the finest tools, materials and workmanship that money could buy, we began building the "Em-re."
The result, a fully-jeweled, precision dial indicator that will consistently (after millions of checking operations) give *repeated*, accurate readings — surpassing A.G.D. tolerances. Furthermore, this is the only 100% shockproof mechanism on the market . . . Stocked in 24 models having 6 ranges from .025" to .250" with graduations in .00005", .0001", .00025", .0005" and .001".

Patents Pending.

See this new line of indicators in Booth 910 ASTE SHOW CHICAGO March 19-25

or
Send today for Bulletin 455-D.

PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

USE READER SERVICE CARD; INDICATE A-1-232-1

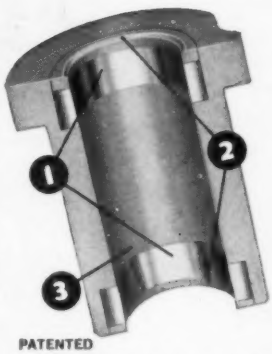
MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES

IN Automation !

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

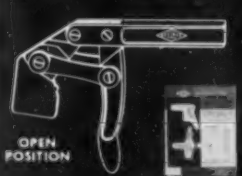
USE READER SERVICE CARD; INDICATE A-1-232-3

announcing 2 NEW

DE-STA-CO

TITAN Toggle Clamps!
(Models 557 and 558)

- THE ULTIMATE IN RUGGED CONSTRUCTION
- completely replaceable parts
- forged steel components
- 4,000-lb. holding pressures
- weight of 4½ pounds!



(Model 557 is the same as Model 558 except that Handle-angle provides *complete clearance*)

Send for
FREE Literature
on these new DE-STA-CO Titans—Models 557, 558!

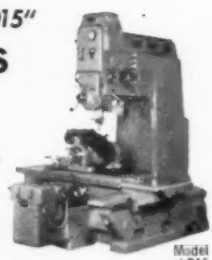
DE-STA-CO DETROIT STAMPING COMPANY
WORLD'S FIRST LINE OF TOGGLE CLAMPS
328 Midland Avenue • Detroit 3, Michigan

USE READER SERVICE CARD; INDICATE A-1-232-2

Fastest initial and repeat settings guaranteed accurate within .00015"

LINDNER JIG BORERS

- Direct reading micro-optical measuring system permanently free of wear. Readings in .00005"
- No gauges, blocks or bars
- Table sizes: 44" x 24"; 32" x 16"
- Over 60 delighted users in U. S. A.
- Send for 20 min. demonstration movie film



Model LB15 with preselective AUTOPOSITIONER

KO CO., INC. INDUSTRIAL IMPORTERS T. M. REG.

KURT ORBAN company, inc.
Harborside Terminal Bldg.,
Jersey City 3, N. J.

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DOWEL PINS

Immediate Delivery!

Standard Size Dowel Pins from ⅛" to 1" diameter and from ⅜" to 6" length supplied in .0002 and .001 over basic sizes. Unless otherwise specified, .0002 oversize will be furnished.

Dealer's Inquiries Invited.

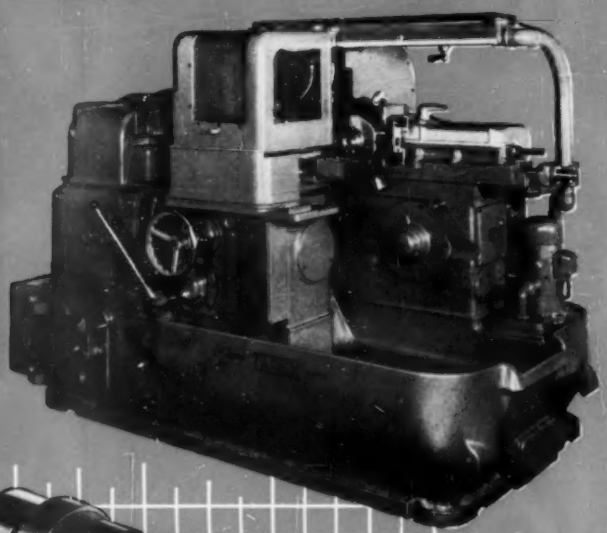
SCHULTZ & ANDERSON CO
111 EDISON PLACE, NEWARK 5, N.J.

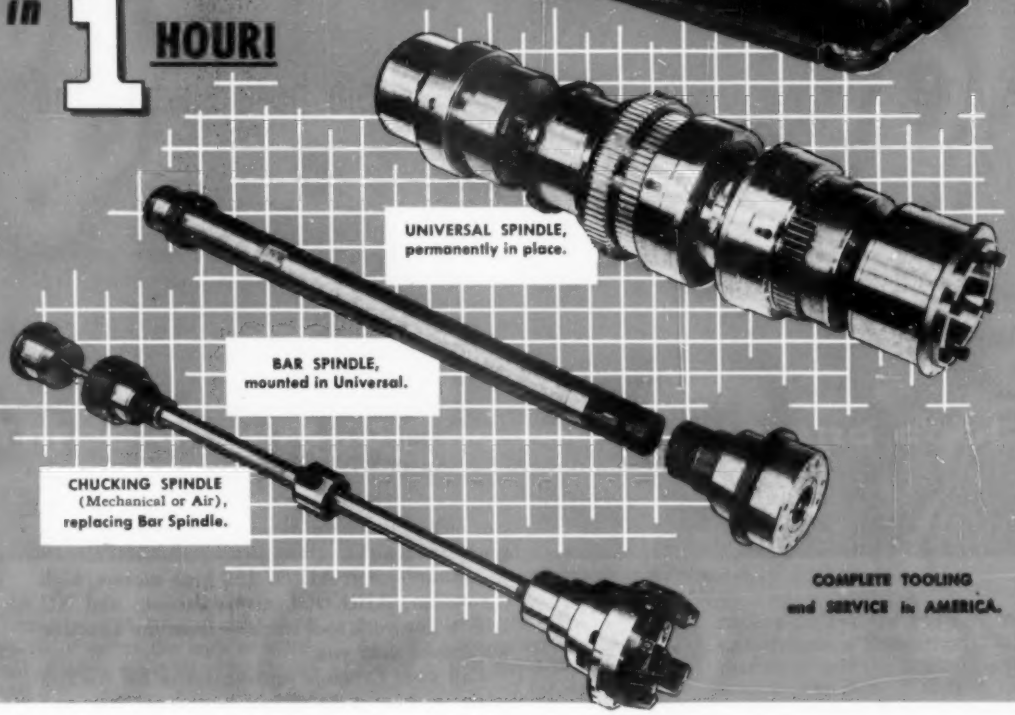
USE READER SERVICE CARD; INDICATE A-1-232-5

TAREX AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

The ability to change from BAR work to a CHUCKING machine in 1 HOUR!

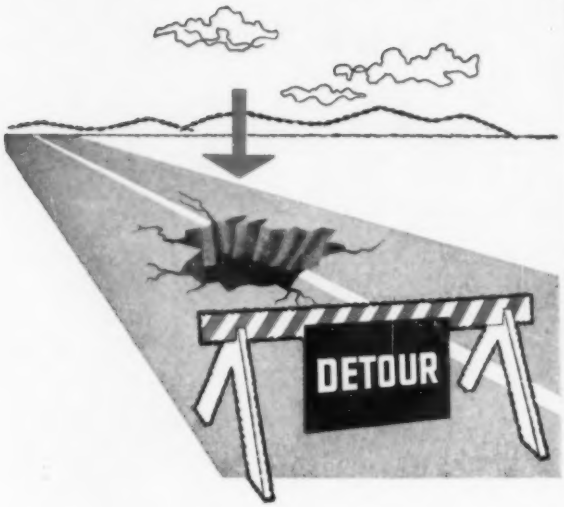



UNIVERSAL SPINDLE, permanently in place.
BAR SPINDLE, mounted in Universal.
CHUCKING SPINDLE (Mechanical or Air), replacing Bar Spindle.

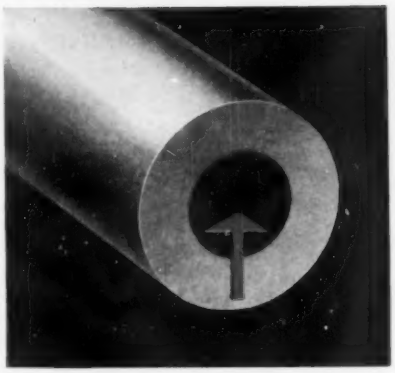
COMPLETE TOOLING and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



a hole here wastes time...



a hole here saves time

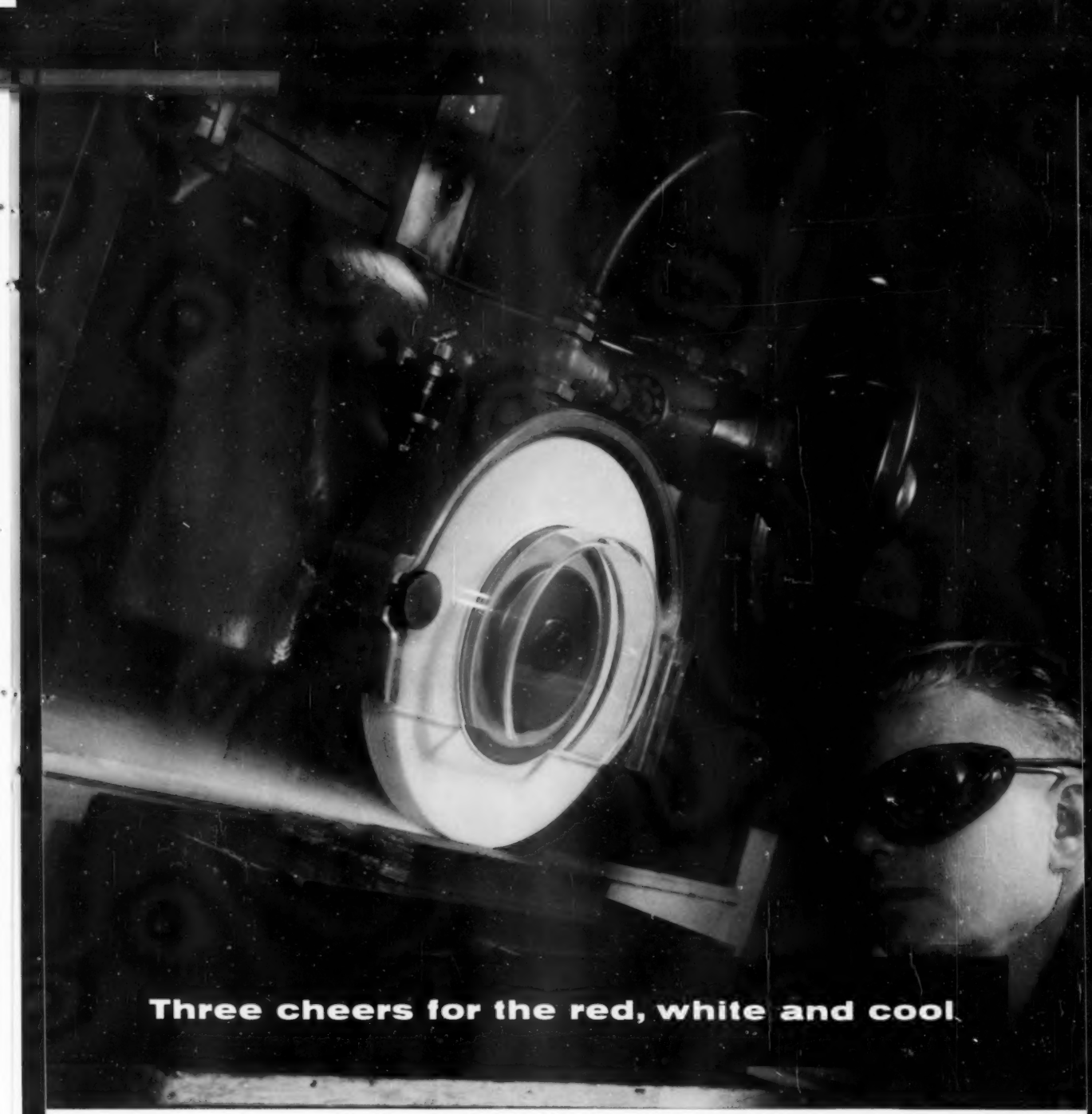
Crucible Hollow Tool Steel Bars save time — and money too — whenever you need ring-shaped steel parts, or tools with a center hole. The tool steel is drilled through when you get it! You don't need to bore, drill, hole-saw, cut off or rough-face. That's why they cut your production time, increase machine capacity — and reduce scrap losses.

You can get these hollow bars in any of Crucible's famous quality tool steels, in almost any combination of OD and ID sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening; SANDERSON water-hardening; AIRDI 150 high carbon, high chromium; AIRKOOL air-hardening; and NU DIE V hot-work tool steels — from the Crucible warehouse near you.

Call your Crucible representative for the full story of how these steels can save time and money in your shop. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



The "see-through" safety guard was specially made for this photo only.

Distinctive RED blotter on a new WHITE wheel is the sign of COOL tool grinding worth cheering about! And that's not all...V40 Bond Tool Room Wheels by CARBORUNDUM cut faster, last longer and permit heavier infeeds without burning the stock or overheating the tool, even on die steels and hi-vanadium types. And the outstanding form-holding ability of V40 Bond Wheels eliminates costly stops for wheel dressing halfway through a job. Try one in your shop today. There's a type for every tool room operation...easily identified by the V40 on the bright red blotter. Your CARBORUNDUM Distributor or salesman will arrange a free demonstration. For Bulletin A-1310, write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

"Home-made" Automatic Drill set-up cuts drilling cost from 2¢ to 1/10¢ per piece

Two standard Dumore Automatic Drill Units plus low-cost tooling boosts production for midwest die cast firm.

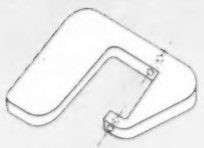
When Acme Die Casting Corp., Racine, Wisc., bid on a die cast zinc automobile door lock, their price hinged on maintaining high production rates on every phase of the operation. However, when hand drilling two opposed .160" holes, they found it impossible to hold the necessary .002" alignment tolerances as well as maintain the required high hourly production. They began looking for a solution.

Uses Dumore Advisory Service

Working closely with Dumore's Application Advisory Service, the company devised the special purpose machine pictured below. It consists of two Dumore Series 24 Automatic Drill Units designed into a completely automatic set-up that amounted to only a few hundred dollars in tooling and fixture costs. Complete synchronization of stroke, feed and drilling is made possible with effective use of micro-switches.

From 150 to 1500 pieces per hour

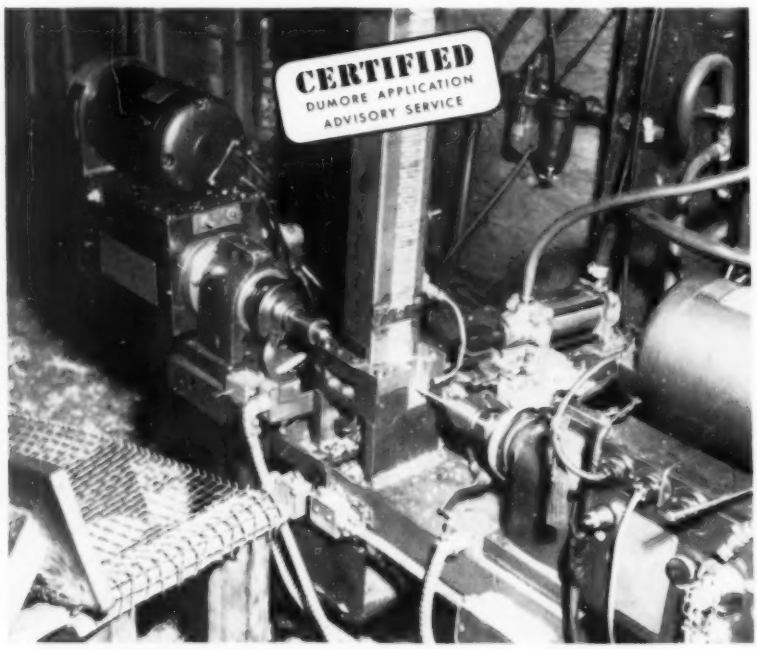
By increasing production from 150 to 1500 pieces per hour, drilling costs were reduced from 2c to 1/10c per piece. Operating at three shifts per day, the Dumore Units and tooling paid for themselves within a matter of weeks.

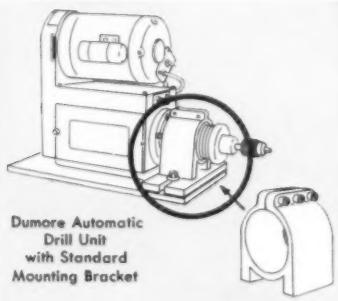


PART: Zinc Die Cast Automobile Door Lock.

OPERATION: Drill two opposed .160" holes, hold alignment within .002", parallelism .0015".

PRODUCTION: 1500 pieces per hour, or 25 per minute.





Dumore Automatic Drill Unit with Standard Mounting Bracket

QUICK REMOVAL and transfer of Dumore Units to other parts of the shop for drilling, tapping, reaming and other related operations is made possible with their unique nose mounting bracket. It quickly adapts Unit at any angle to existing shop equipment.

AN INEXPERIENCED OPERATOR loads the hopper while gravity feed forces the piece into the drilling fixture. The two opposed Dumore Automatic Drill Units advance simultaneously, drill, then retract to starting position—all automatically. The Dumore's built-in electrical and pneumatic controls permit almost unlimited set-up and production possibilities.

DUMORE
PRECISION TOOLS

AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS

Let Dumore's Application Advisory Service help you get increased production and lower costs on jobs like this. Write for FREE Dumore Application Analysis Kit.

1310 SEVENTEENTH ST., RACINE, WISCONSIN

VK

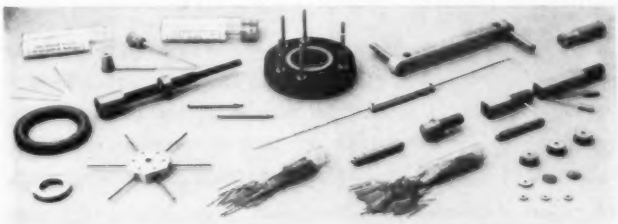
USE OUR SKILLS on YOUR LAPPING PROBLEMS

If that tough production part has Gage Characteristics, try the Van Keuren Precision Lapping Service--

The Van Keuren Co. laps optical flats to an accuracy of .000001", gage blocks to .000004", plug gages to .000010". Your job may not be this precise, but it's a safe bet that VK skills can save you money on lapping problems involving size, flatness, parallelism or fine surface finish. If that tough production part has at least one gage characteristic, ask for a quotation from VK.

We lap flat and cylindrical work in both metals and nonmetals. Sealing rings and plates for pumps and pressure devices, precision pins, spacers, pistons, punches, carbide pivots, valve parts, instrument components and parts for testing inspection equipment, are among the customer items handled economically here in our plant.

If you require lapped or polished surface finishes in the order of .5 to 5.0 RMS, or dimensional tolerances from .000001" to .0001", The Van Keuren Co. can probably help on the problem. The rule of thumb", as suggested above, is "at least one gage characteristic."



Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

VK

37th YEAR

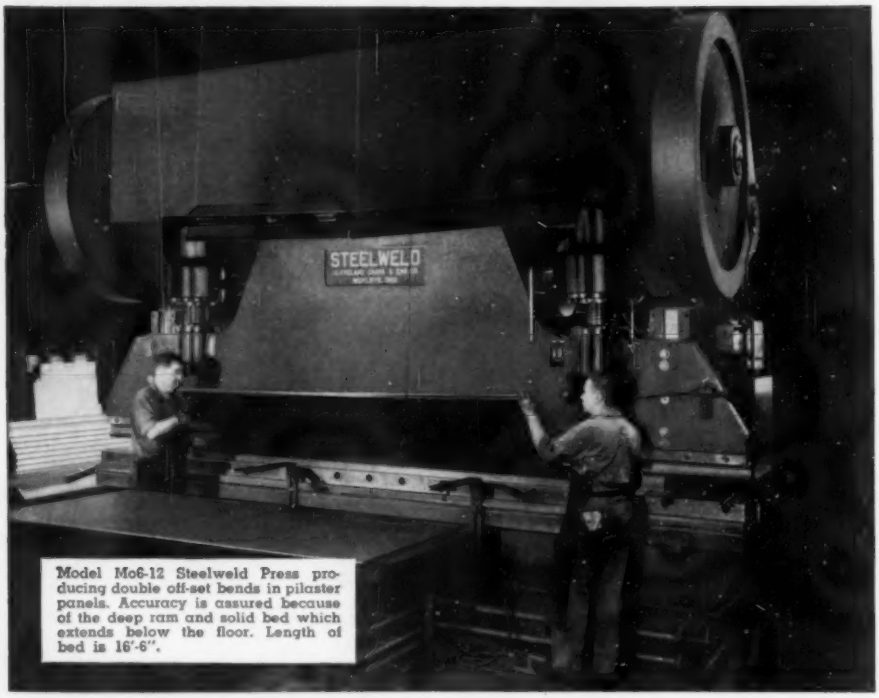
THE Van Keuren CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.

Special Press features

SPEED PRODUCTION



Model Mo6-12 Steelweld Press producing double off-set bends in pilaster panels. Accuracy is assured because of the deep ram and solid bed which extends below the floor. Length of bed is 16'-6".

It takes power to make long sharp bends. It takes size and design to assure accuracy. The Mills Company, Cleveland, Ohio, well-known manufacturers of fine metal partitions achieve both with their big 500 ton capacity Steelweld Press.

But more! They also obtain speed and safety. Their machine is provided with several features that are extremely advantageous:

1. Air-electric control for high production.
2. Electric foot switches for easy fatigueless operation.
3. Ram-positioning selector for stopping ram automatically at pre-selected points.
4. Two speeds, 7 or 21 strokes per minute for best operating speed.
5. Reversing flywheel for quick stopping or reversing of ram at any point.
6. Safety dual control permitting operation only when both operators are ready.

The Mills Company are proud of their modern Steelweld Press. It is the largest of several press brakes in their plant. It is in continuous operation, two shifts a day.

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CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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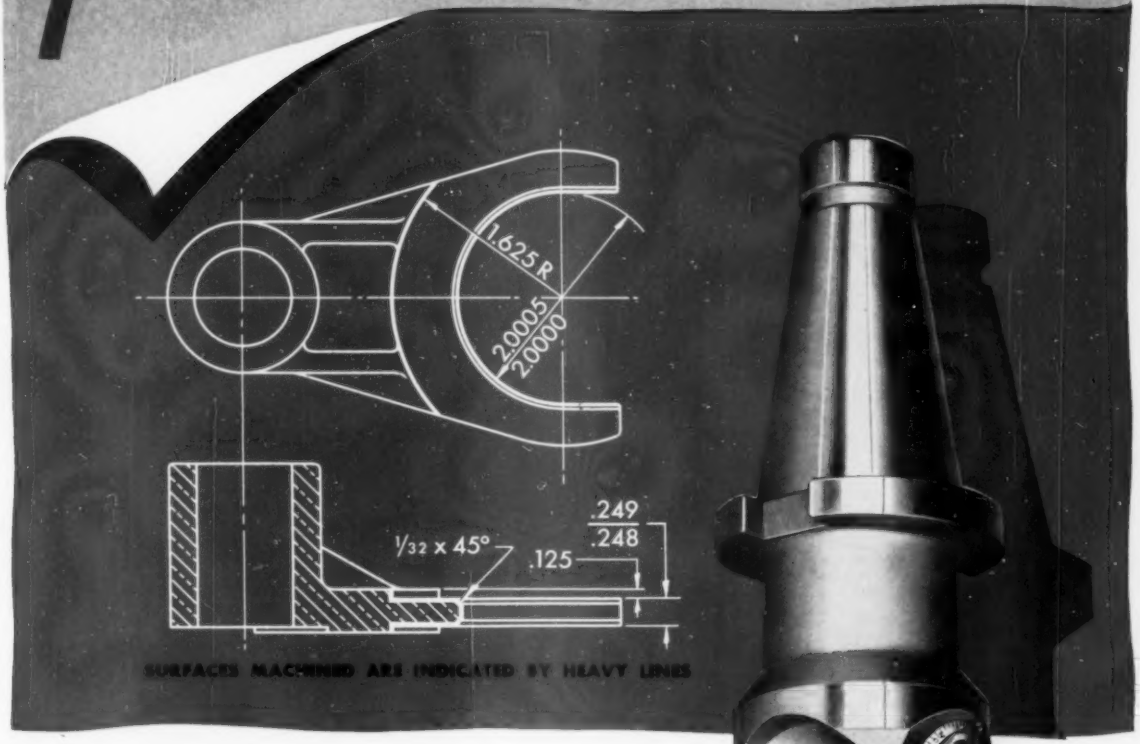
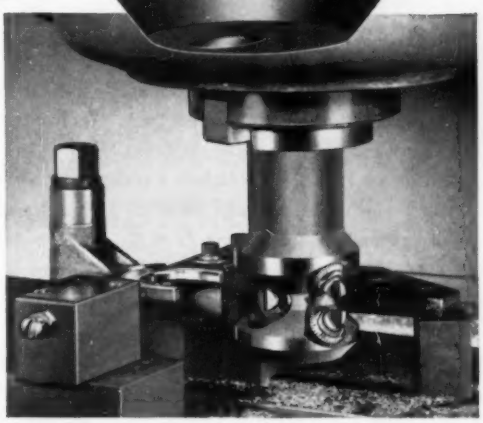
7 SURFACES on SHIFTER FORK MACHINED AT 1 PASS!



And held to precise limits by using MICROBORE® Precision Tooling-

Illustration shows setup for completely machining shifter forks on standard Vertical Milling Machine to precise limits of accuracy on a production basis. This application of Microbore Cluster Tooling permits use of simple low-cost work holding fixture, and substantially reduces tool costs per piece.



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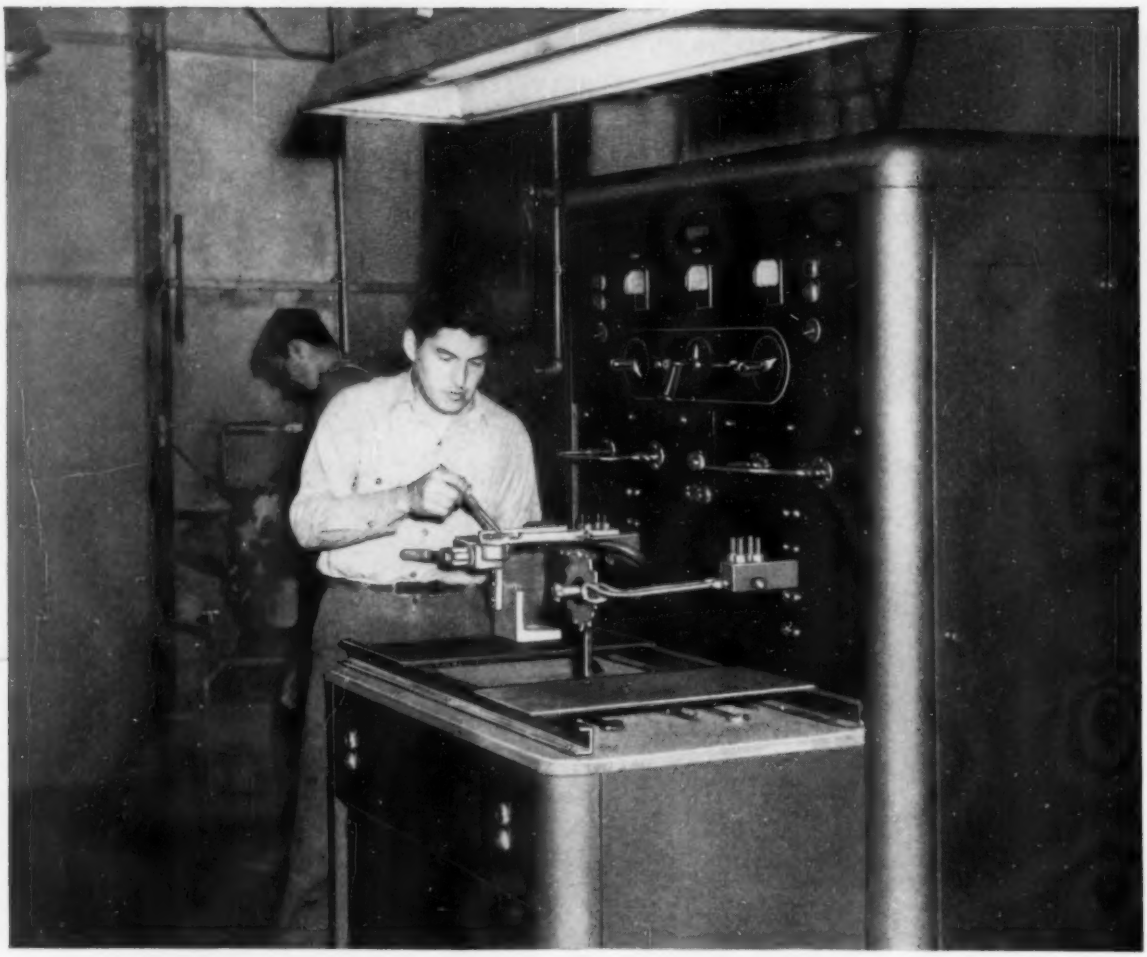

LINDBERG INDUCTION UNIT REDUCES BRAZING COSTS BY 50%

It happened in Hawthorne, California, at the Sonnet Tool and Mfg. Co., manufacturers of HELICARB Helical Carbide Cutting Tools. After installing a Lindberg 25 KW induction unit, average brazing time required for a production run of tools was tremendously reduced, resulting in substantial production economies. At the same time, product uniformity was far superior to that achieved by the previous method.

In addition to the obvious dollars and cents savings in time, labor and brazing materials, the Lindberg unit is cleaner and allows more comfortable operating conditions, according to Sonnet.

Lindberg engineers will gladly provide you with information on equipment relating to your application. See your nearest Lindberg field representative, or write for bulletin 1441.

Left to right: MERLE HILLIARD, *Vice President and General Manager;* E. C. "BUD" SUNDERMAN, *Shop Superintendent,* PAUL SAXMAN, *Chief Engineer*

Shop Superintendent, E. C. "Bud" Sunderman says: "One of the wisest investments we ever made was in our Lindberg induction unit. It has opened up new fields of carbide tooling, and has improved manufacturing procedures."

LINDBERG HIGH FREQUENCY DIVISION

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Tool Steel Topics

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Want Fast Tool Steel Service?

SEE YOUR BETHLEHEM DISTRIBUTOR

Whether you want to order a quantity of tool steel, or merely a short bar, or just would like a bit of advice about the correct method of heat-treatment, you're sure to find your Bethlehem tool steel distributor anxious to be of service.

Prompt service is your distributor's middle name. He makes it a point to know your city like a book—its background, its people, its industry. He knows what grades of steel you are most likely to need, and in what quantities. And so he keeps large stocks of Bethlehem tool steel on hand, in a virtually endless variety of types, all of them ready to go at a moment's notice.

If you would like bars cut to special length, or if there's a tricky phase of metallurgy or some other tool-steel problem troubling you—again, your distributor is at your beck and call. He's a real friend. They don't come any better. It will pay you to get to know him.

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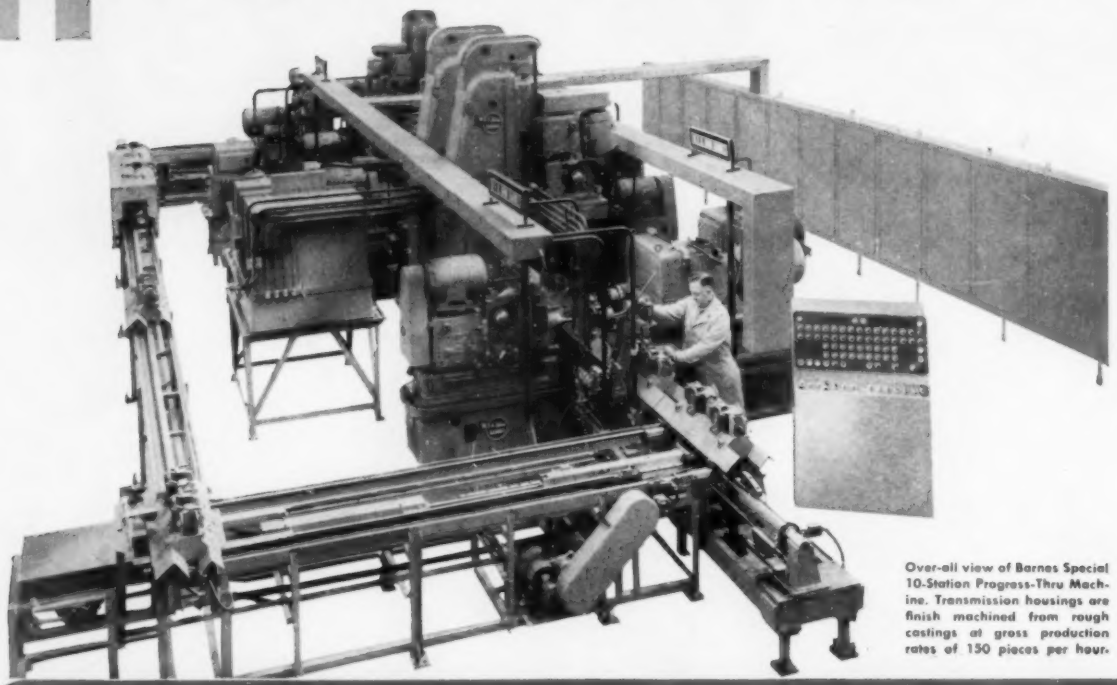
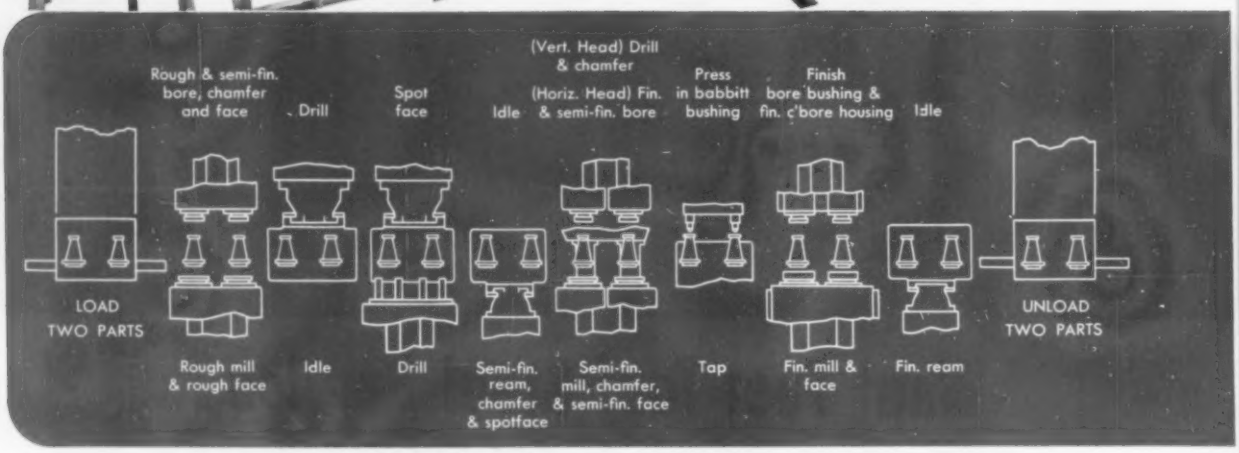
TRANSMISSION EXTENSION

HOUSINGS NOW MACHINED COMPLETE



Over-all view of Barnes Special 10-Station Progress-Thru Machine. Transmission housings are finish machined from rough castings at gross production rates of 150 pieces per hour.



▲ Schematic drawing of machining operations. Total concentricity on all operations does not exceed .002". Housings are held in transfer plates which are located by two hydraulically actuated dowels and clamped hydraulically at each machining station.

Builders of Better Machines Since 1872

W. F. & JOHN BARNES

Special Machine Tools

Special Conveyor Units

Special Process Equipment

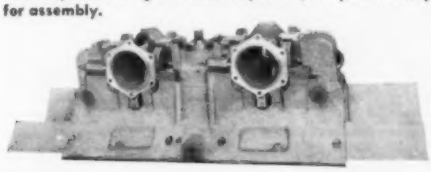
MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

FROM ROUGH CASTING TO FINISHED PART

ON

W. F. & JOHN BARNES SPECIAL 10-STATION PROGRESS-THRU MACHINE

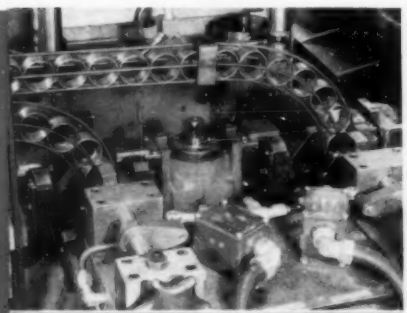
Transmission extension housings are finish machined in automatic cycle from rough casting to finished workpiece. After rapid washing and final inspection, the part is ready for assembly.



View of workpieces in special transfer plate fixture. Both housings are located and accurately positioned by means of dowels and screw-operated V-block clamps.

Here is another typical example of how W. F. & John Barnes Six-Point Machine Tool Building Service has helped increase production efficiency for a leading automobile manufacturer. All machining operations on transmission extension housings are now combined in one Special Barnes 10-Station Progress-Thru Machine at a production rate of 150 pieces per hour. Two operators, one at the loading end and the second at the unloading end, load and unload housings on transfer plates which carry workpieces through the entire machining cycle. Operations include boring, facing, milling, drilling, reaming, automatic press-in of babbitt bushings, and combination finish bore babbitt bushing and finish counterbore housing.

Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.



Closeup of station seven where babbitt bushings are automatically pressed-in to the small end of the housings. Bushings are hopper loaded by operator at the unloading station.

BARNES' COORDINATED 6-POINT MACHINE TOOL BUILDING SERVICE INCLUDES:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
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6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

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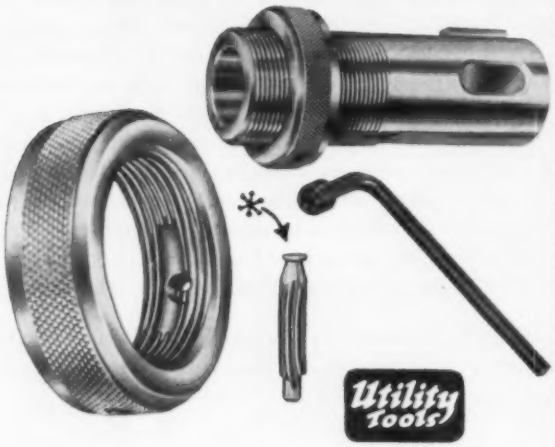
AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

The GLENLOK Adjustable Adapter NUT Has a Floating Lock* That Can't Break Off



This new nut eliminates broken sections sometimes referred to as fingers. It has been tested on production in one of the big three auto plants for over a year and is now being made available to industry for the first time.

Hardened and Ground

These nuts are heat treated and then ground so they are always accurate by thousandths of an inch wherever set. This Glenlok Nut is the new standard adopted by Glenzer for use on Adapters, Floating Holders and all tools using National Acme Threads. This nut locks over milled drift slots or old style Adapters with milled set screw flats.

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Ideal for quick tool changes on multiple spindle machines.

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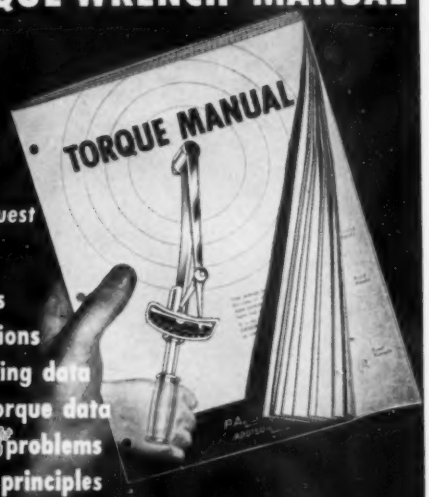

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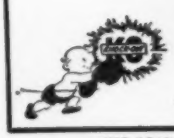

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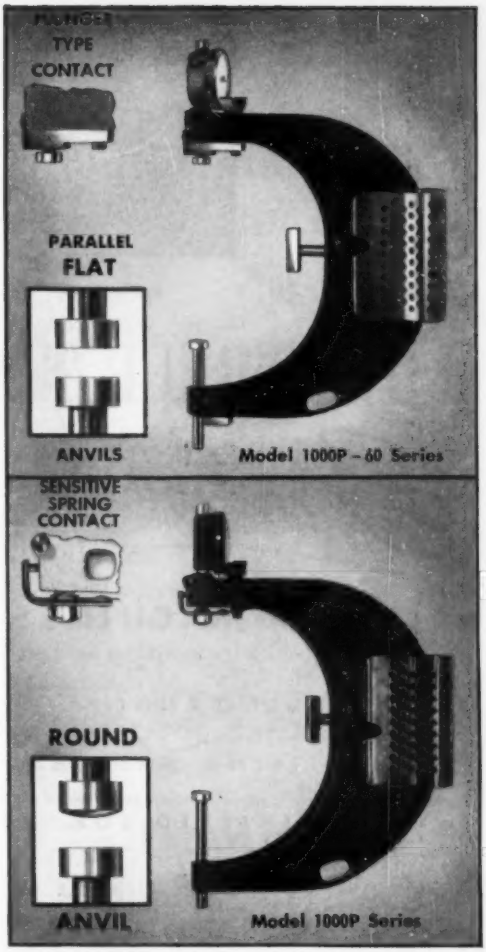
Either TUNGSTEN CARBIDE for enduring accuracy or STEEL for price.



FLAT, PLUNGER ANVILS where anvils must gage close into corners of shoulders and yet remain perfectly parallel at all times. Gage is adjustable yet maintains accuracy, graduated in tenths.

ROUND, SPRING ANVILS for more general requirements. Sensitive contact: spherical. Lower: flat and adjustable. Inexpensive, fast and accurate, graduated in tenths.

SMALL FLAT ANVILS either single dimension or adjustable. Gages close to shoulders – anvils remain parallel. Light, sensitive, positive. Nearest style to "fixed" snap gages.

RETRACTING ANVIL for super finishes and soft material. Sensitive, flat lapped anvils remain parallel throughout adjustment.

RUGGED PLUNGER TYPE for heavy duty. Upper anvil has spring tension sufficient to counteract weight of gage and operator's hand.

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We make Indicating Snap Gages to suit any whim or necessity

These Gages are made to meet all the usual physical and accuracy needs of gage users. They can be had in a wide range of sizes and can be modified to suit particular needs. If you haven't seen just what you *must* have, ask us about what you want. We also make Air Snap Gages.

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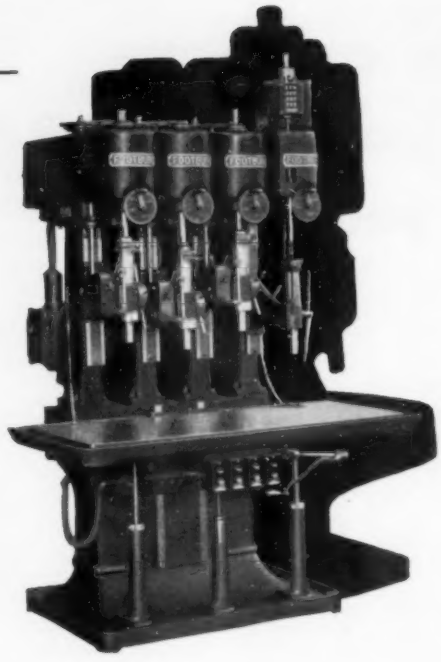
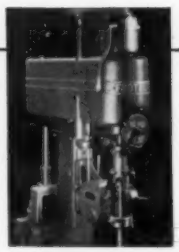


■ No. 2 Machine with Back Gear • 12" Overhang • ⅝" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

■ Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counterboring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.



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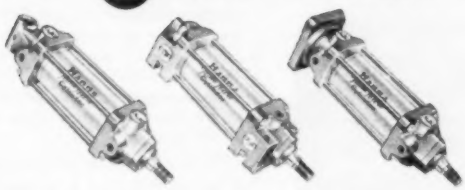
FLUID T750 POWER CYLINDERS



The new Hanna T750 Series cylinders are the last word in smooth, dependable performance. These rugged, compact cylinders are built for air operation to 250 p.s.i. and oil or water operation to 750 p.s.i. Many mounting styles and interchangeable heads make these cylinders exceptionally versatile. Available in 1½", 2", 2½" and 3" diameters.

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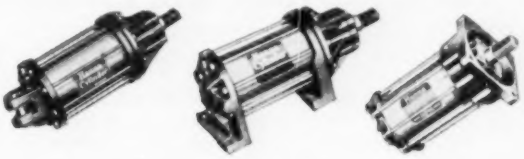
AIR & HYDRAULIC CYLINDERS



For low pressure air and hydraulic operation. Thousands of varied applications have proved the quality and reliability of these Hanna cylinders. Bore sizes range from 4" to 14". These cylinders, combined with Hanna T750 Series cylinders, offer a complete range of cylinder sizes and mounting styles. Made in any practical stroke length.

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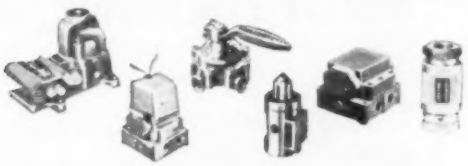

Designed to provide most efficient control for Hanna cylinders — ideal for other fine control jobs too. Many types available for hand, foot and electric operation, speed control, pilots and master for automatic and remote control.

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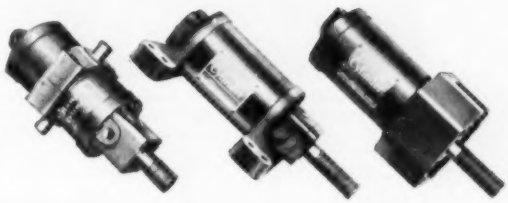
Hanna HP

HYDRAULIC CYLINDERS



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These accessories provide complete protection for precision-built cylinders and valves—will keep maintenance costs at a minimum.

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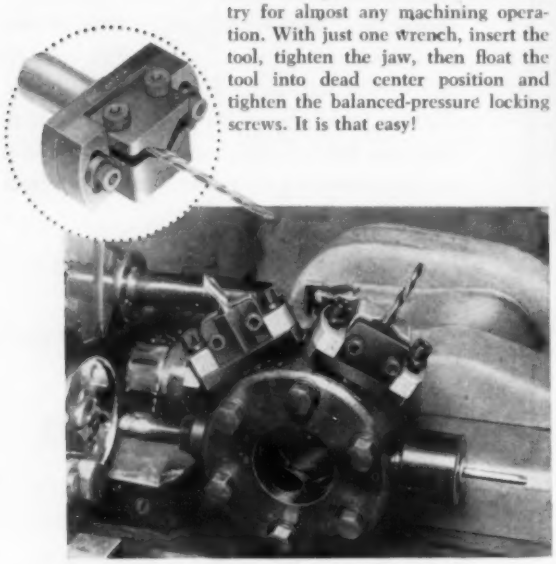
New Brookfield tool holders cut set-up time, tool inventories

Precision ground V-jaw vises, Brookfield Tool Holders assure top-quality work every time! Without bushings or collets, drill, counterbore, reamer or cutter set ups can be made on the first try for almost any machining operation. With just one wrench, insert the tool, tighten the jaw, then float the tool into dead center position and tighten the balanced-pressure locking screws. It is that easy!



Brookfield floating drill holders being used in a Model OOG Brown and Sharpe automatic screw machine at IBM's Poughkeepsie, N. Y., plant.

Think... here is what production men at IBM's Poughkeepsie plant say:

"Brookfield Holders are being used in our Automatic and Hand Screw Machine Departments with considerable success and satisfaction."

"They hold a wide range of drill sizes in V jaws, with excellent alignment, producing a fine quality part. There is no alignment problem due to worn or distorted bushings or collets inasmuch as it is not necessary to keep bushings and collets in stock."

"Through the use of Brookfield holders there has been a definite reduction in set-up time, and the production of only top quality parts has been assured."

Patent No. 2472040

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SPEED UP Screw Machine Production

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We manufacture cams and tools for the trade on a production basis. As a result we offer:

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3. Correct specifications which insure maximum service.

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Let us quote on your tool requirements. You'll save money . . . even as compared with "home made" tools.

Standard circular form tools for B&S and Davenport Machines carried in stock. Immediate delivery.

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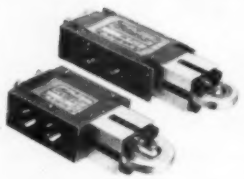

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CRV SERIES VALVES now available in 3 or 4-way hand lever, palm button, foot control, cam, roller or pilot-operated types. Prices range from $11.30 to $15.95, f.o.b. factory.

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S-200 REVIEW OF AIR GAGING
In "A Review of Pneumatic Dimensional Gages", Louis Polk, chairman and president of The Sheffield Corporation, describes the different types of air gages, their applications and uses. Amply illustrated with schematic drawings of pneumatic circuitry and photographs of multiple-dimension and automatic air gages. Contains selective bibliography on air gaging. 24 pages.

S-201 THEORY OF GAGING
Reprint from an address before the American Society of Mechanical Engineers, this six page technical paper reviews the operating principles of several types of mechanical, electrical, electronic and pneumatic gages. Many schematic drawings.

S-202 66 CENTURIES OF MEASUREMENT
Commemorative booklet issued at the time the permanent exhibit of precision measuring instruments was established at the Smithsonian Institution, Washington, D. C. Includes 16 colored drawings depicting significant periods and advancements in the history of measurement since 4700 B.C.

S-203 VISION IN METROLOGY
Printed from an address by Louis Polk, this pocket size booklet tells the story of measurement from the Cubit of the ancients to the "Barn" of the atomic age. In conclusion, the author presents some stimulating thoughts about the methods for dimensional control in the future.

S-204 ELI WHITNEY METROLOGY LABORATORY
This pocket-size booklet describes the construction, Inspection environment, and instrumentation in Sheffield's newly opened laboratory for precision measurement. Lists the types of Measurement and Inspection services available to Industry including Gage Block and End Measure Calibration, Hardness Testing, and Surface Finish Analysis.

S-205 CATALOG
Twelve page, easy-to-read catalog containing application and engineering data on standard Sheffield control units for automatic machine control, gaging, classifying, and segregating processes. Many photographs and diagrams of typical automated production processes.

S-206 THE SHEFFIELDER
A 4-page newspaper written for shop, production, and inspection personnel. Mailed free-of-charge 4 to 6 times a year. Contains feature articles and photographs on new gages and inspection instruments, better inspection practices, and news from Sheffield's Machine Tool Division.

S-207 GENERAL CATALOG
New 16-page, fully illustrated General Catalog of Sheffield Precision Products and Services. Included are Thread and Form Grinders, Annular Form Grinders, Crushtrue Grinding Machines, Threading Machines, Taps, Chasers, and Ultrasonic Machine Tools; also, Precisionaire inspection gages, Automatic and Multiple dimension gages, Toolroom and Inspection Instruments, and Contract Services.

S-208 NON-CONTACT X-RAY GAGE
A 16-page catalog describing the Sheffield "Measuray"—a non-contact X-Ray gage for continuous or intermittent measurement of strip or sheet stock while in motion or stationary—hot or cold. Contains models and capacity ranges as well as types of materials on which it can be used.

S-209 PRECISIONAIRE INSTRUMENTS
This 30-page catalog and price list on Precisionaire column-type air gages contains the full line of base instruments, with their amplifications and scales, and complete lists of standard sizes and types of air spindles, air snaps, Plunjet gaging cartridges, and types and sizes of adjustable air tooling.

S-210 PLUNJET GAGING CARTRIDGES
A 24-page catalog showing types, sizes, amplifications, tolerance and ranges of Sheffield Plunjet gaging cartridges. Contains engineering and technical data on the use of Plunjets to single and multiple dimension inspections and for machine control applications.

S-211 AIR GAGING JET ENGINE BLADES AND BUCKETS
The critical dimensions and conditions of jet engine blades or buckets and how they are gaged quickly and accurately with Sheffield Precisionaire gages are described in this 28-page catalog.

S-212 ADJUSTABLE AIR GAGE TOOLING
Engineering Data Sheets describing types and sizes of adjustable air gage tooling for use with Precisionaire instruments and other makes of air gages. Gages for measuring inside diameters include four adjustable spindles with ranges from ½" to 9/16", 9/16" to 1", ¾" to 1 ½" and 1 ½" to 3"; also, the adjustable Airebore Gage Kit for any size bore from 2" to 12", and the 1" to 3" adjustable Balljet spindle kit. Standard 1" adjustable Plunjet Snap gages are available covering the range from 0" to 12".

S-213 AIRETEST INDICATOR
An 8-page Engineering Data Sheet covering the use of the Sheffield Airetest Indicator with the column type Precisionaire. It describes how this new style pneumatic pickup unit is used to accurately determine height, flatness, parallelism, and concentricity.

S-214 PLUNJET STEEL AND STONE FLATNESS GAGES
This Engineering Data Sheet shows how a Plunjet gaging cartridge applied to either a steel or stone surfaceplate makes an ideal combination for checking flatness to a high degree of accuracy.

S-215 PLUNJET EXTERNAL GRINDING GAGES
Engineering Data Sheet showing how a Plunjet gaging cartridge is used with Foster and Arnold Visual Grinding Gages to indicate stock removal evenly without oscillation or flicker normally associated with a dial indicator reading.

S-216 CRUSHTRUE WHEEL DRESSING PROCESS
What Crushtruing is and how it can be used is told in this 12-page catalog. Contains types and sizes of Crushtrue devices available for both surface and cylindrical grinders, and information on their selection. Many case histories and illustrations.

S-217 PRECISION THREAD AND FORM GRINDERS
Machine information and specifications catalog on Models 101, 103, 105, and 107 Preci-lon Thread and Form Grinders. All models capable of plunge grinding.

S-218 MODEL 109 PRECISION ANNULAR FORM GRINDER
Use and specification information on this grinder which has a capacity of 12" between centers and will grind a maximum diameter of 4" with a 14" wheel, and will accommodate work up to 7" in diameter.

S-219 MODEL 180 CRUSHTRUE MULTI-FORM GRINDER
An 8-page catalog covering machine features and specifications of new model 180 Grinder. This machine uses a 4" wide Crushtrue dressed wheel and will grind work up to 10" in diameter and will accommodate a workpart 24" long. Features automatic grinding and gaging, automatic Crushtruing and automatic compensation for wheel wear after dressing.

S-220 MODEL 134 PRECISION THREAD AND FORM GRINDER
Both single and multi-pass models are described in this 8-page catalog. Model 134 is used to grind threads up to ½" diameter x 4" long within a pitch range from 20 to 120 T.P.I. Machine features include automatic grinding cycle, automatic wheel dressing, and automatic compensation.

S-221 MICRO-FORM GRINDERS
An 8-page catalog with inserts covering Sheffield's Micro-Form Grinders. These machines grind circular and flat form tools, templates, profile gages, cams, and Crushtrue rolls, etc., directly from a drawing of 50:1 ratio. Neither templates nor masters are required. Work is checked without removing from machine.

S-222 MODEL 140 GEAR GRINDER
An 8-page catalog containing machine and specification information on this reciprocating type gear grinding machine that is used to produce precision ground helical and spur gears from 8 to 50 inch. Crushtrue is used to form the grinding wheel to the basic rack form. Maximum work diameter is 8" and grinding stroke 4".

S-223 GEAR DEBURRING MACHINES
Machine features and specifications of seven models of gear deburring machines are described in this 8-page catalog. Both single and two station models are included.

S-224 GEAR AND SPLINE DEBURRING MACHINES
Six standard models and their specifications are included in this 8-page catalog. These machines are used for precise chamfering, tooth rounding or pointing of gears and splines. Gears up to 13" in diameter can be handled on standard machines—larger on special.

S-225 MACHINING THE UNMACHINABLE
A 16-page booklet describing the techniques, advantages, uses and machines for ultrasonic machining of hard materials such as carbides, glass, and ceramics.

S-226 AUTOMATIC WELDING MACHINES
A 4-page Engineering Data Sheet describing both Point and Disk type welding machines that are used for automatic welding of point and disk shape contacts of precious and semi-precious metals to small contact arms, leaf springs, and instrument components. Examples of metals that can be welded are gold, silver, platinum, palladium, and iridium.

S-227 THREADING TOOLS — TAPS AND DIE HEADS
A 16-page catalog showing a large variety of types and sizes of the threading tools available from the Murchey Division of Sheffield. Included are collapsible taps and self-opening die heads, solid taps, chasers, and chaser accessories for setting and grinding.

S-228 PRECISION THREADING UNIT — PRECISION-PAK
The Sheffield PRECISION-PACK, a self-contained precision threading unit that can be used also for boring, chamfering, and reaming is described in this 4-page folder. Threading capacity: Internal—1 ½" to 4"; External ¾" to 4"; Maximum pitch 8.

S-229 THREAD ROLLING ATTACHMENT — PRECISION-ROL
A 4-page folder covering five standard models of PRECISION-ROL thread rolling attachments for automatic screw machines and turret lathes. Many case histories with threading production times included.

S-230 VISUAL GAGES
A 20-page catalog on the "Shop Proof" Visual Gage—an indicating comparator which is set by precision gage blocks or master gages. Includes types, sizes, amplifications, accessories, and their use in receiving, production, and final inspection.

S-231 ELECTRONIC GAGE BLOCK COMPARATOR
Engineering Data Sheet covering the Sheffield Electronic Gage Block Comparator that is used to calibrate gage blocks to reference masters to a certified accuracy of several millionths of an inch. Available with dual amplifications of 50,000/200,000, 10,000/100,000 or 10,000/20,000 to 1.

S-232 ELECTRONIC HEIGHT INDICATOR
Engineering Data Sheet on this Height Indicator that has a vertical range 0" to 26" and standard amplification of dual 1,000/2,000 to 1.

S-233 ELECTRONIC LEAD MEASURING INSTRUMENT
A 4-page Engineering Data Sheet describing an Electronic Leadchek which will handle work up to 36" between centers and a maximum diameter of 10". Standard remote Electronic Amplification, 2,000 to 1.

S-234 ELECTRONIC INTERNAL MEASURING INSTRUMENT
A 3-page Engineering Data Sheet covering Type N-6 Internalchek used to inspect master and ring gages and other high precision work for size, taper, bellmouth, and out-of-roundness. Standard inspection range .370" to 12", with a vertical range up to 1 ½". On special order, diameters down to .240" can be inspected.

S-235 DIMENSIONAL CONTROL AND GAGING POLICY
A 40-page booklet containing important information for inspection personnel on gages and gaging policy, gagemakers' tolerances, unilateral and bilateral gage tolerances, and the care, control and use of gages. Also, included are diagrams and charts on Unified and American Standard Screw Threads.

THE SHEFFIELD CORPORATION
Dayton 1, Ohio, U. S. A.

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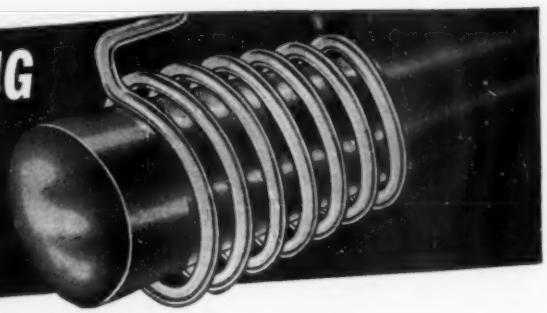

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Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

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Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.

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Ideal for annealing, stress-relieving, normalizing or preheating selected areas.

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Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.

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Induction

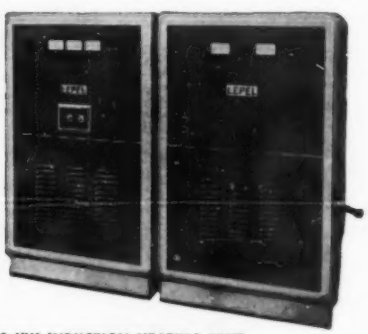
HEATING UNITS

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

2½ KW INDUCTION HEATING UNIT

30 KW INDUCTION HEATING UNIT



100 KW INDUCTION HEATING UNIT

LEPEL Electronic Tube GENERATORS
1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

LEPEL Spark Gap Converters
2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information on high frequency induction heating.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
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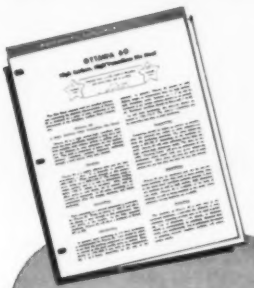


Write for a copy of the OTTAWA 60 BLUE SHEET

This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.

ADDRESS DEPT. TE-73

OTTAWA 60 is a *new* die steel, an A-L "original," developed primarily to deep draw and form stainless steel. As intended, it performs without galling or pickup and shows exceptional wear resistance in that service. We have plenty of case histories to show you in proof.

But *wherever* you use Ottawa 60 draw dies—not just on stainless steel—this high-carbon, high-vanadium alloy comes through for you. Illustrated above are the first and second draws on transformer housings, produced from .037" gauge SAE 1010 strip. The company formerly used dies made of 5% chrome air-hardening die steel—and later a more highly alloyed material—without ever getting more than about 2000 pieces before the dies began to show gall marks and pickup, and parts were rejected due to scoring, breakage and oversize. *Dies made from Ottawa 60 forgings cured that! Results after 25,000 pieces showed no pickup and no wear on punch or die.*

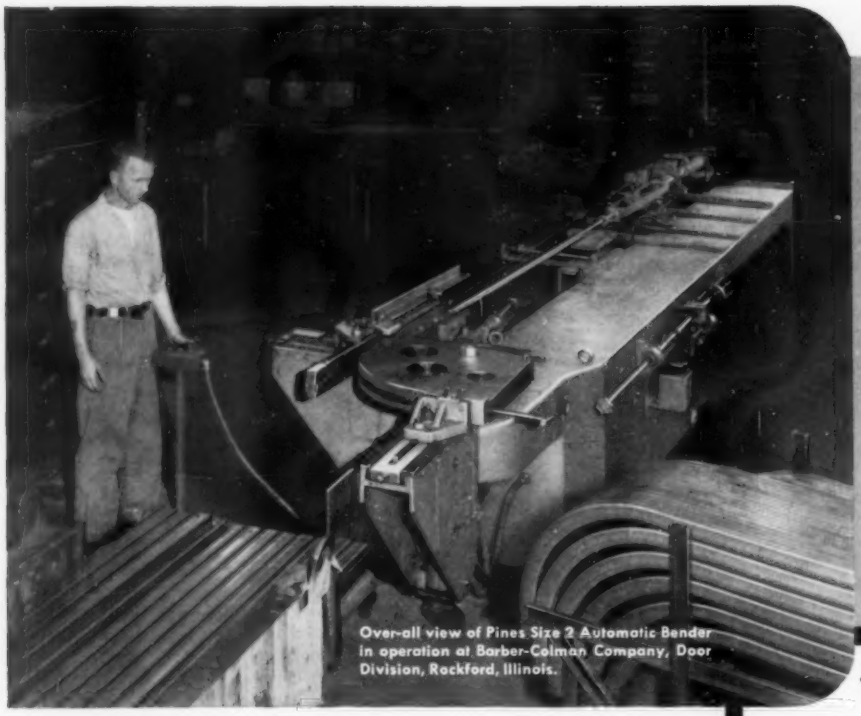
● You can solve many a problem and save real money with Ottawa 60 draw dies! Write for information or call in our Field Service Staff to help you get started. ***Allegheny Ludlum Steel Corporation, Oliver Bulding, Pittsburgh 22, Pa.***

For complete **MODERN** Tooling, call

Allegheny Ludlum

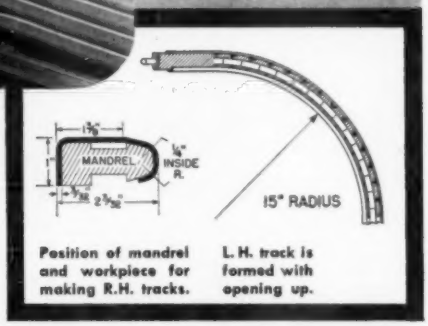
W&D 5463

AL® FINE TOOL STEELS SINCE 1854



Over-all view of Pines Size 2 Automatic Bender in operation at Barber-Colman Company, Door Division, Rockford, Illinois.

Steel Channel Costs Cut 15% AT BARBER-COLMAN CO.



Position of mandrel and workpiece for making R.H. tracks.

L.H. track is formed with opening up.

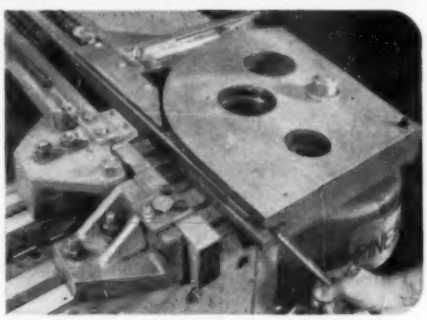
PINES AUTOMATIC BENDER

BOTH L.H. AND R.H. BENDS PRODUCED WITH SAME TOOLING

● Here's another outstanding example of how production bending the "Pines-Way" cuts costs . . . this time for Barber-Colman Company, leading manufacturer of top quality commercial and residential garage doors. By roll shaping door channels from flat stock, then cold bending in a Pines Size 2 Machine, costs have been reduced from 15% to 20%. Formerly, finished channels purchased in lots of 1,000 required extra storage space and a considerable inventory investment to meet the increased demand for "BARCOL" overhead doors. Today, the channels are easily produced as they are needed, which cuts inventory costs, reduces storage and handling problems, and improves delivery.

Smooth, Neat Bends Produced at Production Speeds

As illustrated, 90° bends are formed in HR 13-gauge (.094) steel channels on an inside radius of 15". Of special interest also is that both left and right-hand channels are formed with the same tooling. Smooth, neat bends are produced at production speeds without wrinkling or distorting. As shown in drawing, R.H. tracks are produced with opening down, and L.H. tracks with opening up, which eliminates swing of 8-foot leg. Change in angle specifications are met by the simple angle-of-bend settings on the machine. Setup and operation of machine is handled by semi-skilled machinists.



● Closeup of tooling used for making 90° bend for right-hand track. Flexible mandrel, inserted in channel, insures smooth, wrinkle-free bends. Bending arm speed is 6.0 r.p.m.

Write **FOR MORE DATA ON LATEST COST-CUTTING APPLICATIONS . . .**

If you would like up-to-date case-study data on production bending applied to steel channels, rods, extrusions, pipe or tubing jobs, write for free copies of "Pines News". Or ask for a Pines engineer to call and assist you with any tooling or production problem.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery · 693 WALNUT · AURORA, ILLINOIS

PRODUCTION BENDING · DEBURRING · CHAMFERING MACHINERY

"Economical Buying of Screw Machine Products Now Calls for Greater Care in Specifications,"

says Leonard Schaffer, President, Mechanical Art Works, Inc., Newark, New Jersey

A few typical fine-finish, close tolerance screw machine products currently produced from ANACONDA Rods at the Mechanical Art Works.

"The tremendous versatility of automation in modern manufacturing has placed a bigger burden on the designer and buyer of screw machine parts," Mr. Schaffer explains. "The trend toward miniaturization has shifted many more parts to the screw machine. And the screw machine's ability to provide *tolerances* as close as .0005", and finishes heretofore obtainable only by centerless grinding, has left a tremendously wide choice in specifications."

Mr. Schaffer, a long-time user of Anaconda products, says, "I can count on the uniform machining characteristics of ANACONDA Rods from batch to batch, which is important for both quality and economy in my business."

For complete data on composition and machinability of standard ANACONDA Alloys, standard specifications, weights and dimensions of standard rods, write for Publication B-14. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

5583

A few of Mr. Schaffer's suggestions to buyers of screw machine products for keeping costs down.

Wherever possible, the largest diameter of the piece should correspond to a standard stock rod diameter.

Avoid fancy shapes calling for expensive forming tools.

Use hole diameters obtainable with standard tools.

Allow commercial tolerances if possible, otherwise specify tolerances no closer than necessary.

Specify Standard National Coarse or National Fine Threads wherever possible.

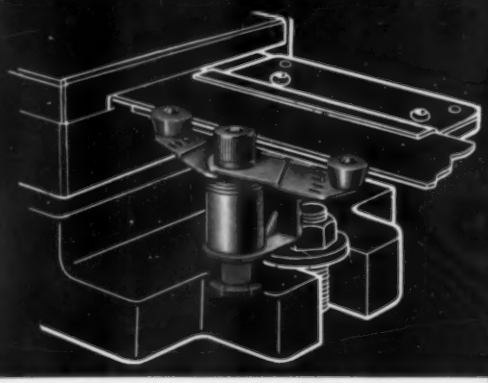
On external threads, cutting full threads close to a shoulder is expensive —and may be unnecessary.

Tapping blind holes close to the bottom is difficult and costly.

Specify free cutting material unless special physical properties are required, then select the best machining material containing those properties.

ANACONDA® RODS FOR SCREW MACHINE PRODUCTS

NOW...
A Low-Cost Stock Guide



NEW DANLY ROLLER STOCK GUIDES AND GUIDE RAILS

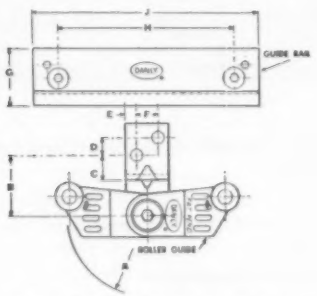
READY MADE—QUICK TO INSTALL

Versatile...for use on dies or in any operation where coil or strip stock must be guided.

Low-cost...the cost is only a fraction of the shop expense necessary to tailormake a guide.

Rugged...constructed entirely of steel. Rollers, arms, collar and bracket are hardened. Adjustable, three-coil music wire spring.

Roller Guide, Large.....$4.50 each
Roller Guide, Small.....4.00 each
Guide Rail.....$3.50 box of five (all one size)
(Discount for quantity orders)



Roller Guide Dimensions, Inches

	Cat. No.	A	B	C	D	E	F
Roller Guide Large	9-70-6	2 3/64	1 15/32	5/8	1/4	5/16	7/16
Roller Guide Small	9-60-6	1 27/64	1 1/16	7/16	5/16	5/16	3/8

Danly Roller Stock Guides packed one to a box unassembled, furnished with light or heavy-duty spring for optional use plus all necessary mounting screws and mounting instructions.

Guide Rail Dimensions, Inches

	Cat. No.	Max. Stock Thickness	G	H	J
Guide Rail	9-8025-6	.025	1	3 1/8	4
	9-8045-6	.045	1	3 1/8	4
	9-8080-6	.080	1	3 1/8	4
	9-8125-6	.125	1	3 1/8	4

Danly Guide Rails packed five of one size per box, furnished with mounting screws and dowel pins.

For immediate delivery, specify catalog number and mail orders to

DANLY MACHINE SPECIALTIES, INC.
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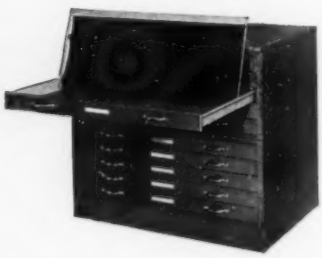

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Electrically welded heavy gauge steel protects and supports your drawings. Special roller bearings and channels provide fingertip control of drawers.

Strength, durability, efficiency, ease of operation—all Mayline features. Protect your time and money investment in drawings. Use Mayline Metal Plan Files.

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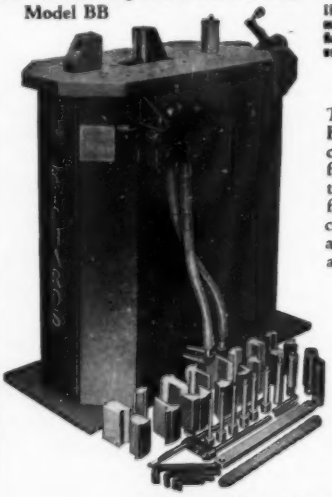
Multiform
BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BB



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra.

Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material. These machines are solving new forming problems in many plants and could be the answer to yours.

Send for illustrated folder TE-5

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Kalamazoo, Michigan

J. A. RICHARDS CO.

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Time and Tool Costs are Cut by using Putnam End Mills. For, they are properly designed and carefully manufactured for free cutting action, longer life and ability to "stand-up" when operated at high speeds and heavy feeds.

Proven Putnam End Mill superiority assures the ultimate in efficient milling of dies, tough-to-machine materials, non-ferrous metals, etc. Give them a try on your rugged milling operations and watch them really "hog" in and remove stock.

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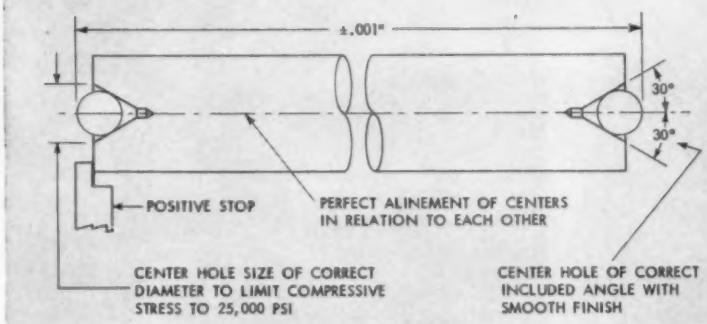
CENTERING IS CRITICAL

FOR TRACER AND AUTOMATIC LATHE PRODUCTION


±.001"
30°
30°
POSITIVE STOP
PERFECT ALINEMENT OF CENTERS IN RELATION TO EACH OTHER
CENTER HOLE SIZE OF CORRECT DIAMETER TO LIMIT COMPRESSIVE STRESS TO 25,000 PSI
CENTER HOLE OF CORRECT INCLUDED ANGLE WITH SMOOTH FINISH

The above sketch graphically highlights the centering "musts" for work to be automatically machined between centers.

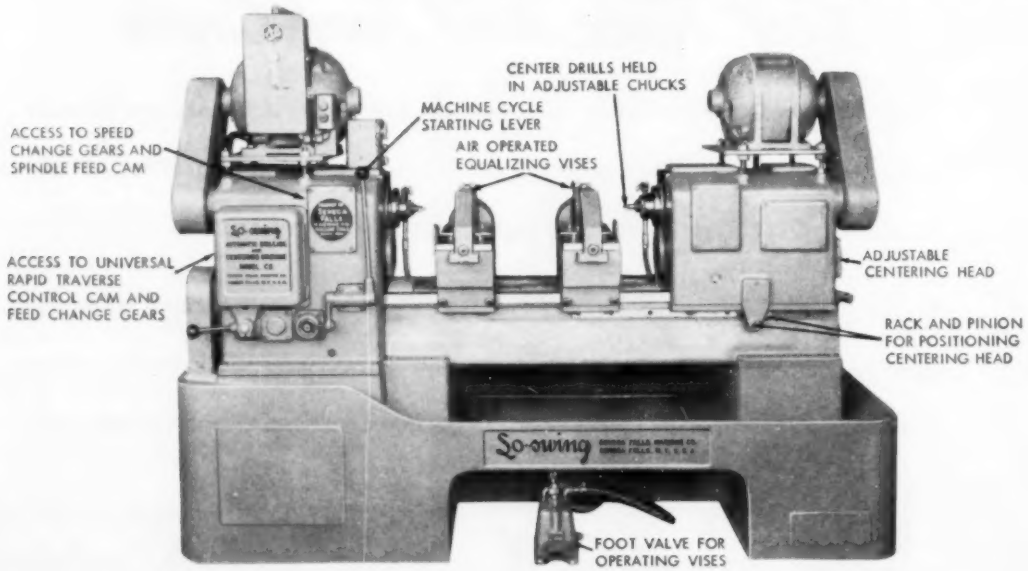
Model CS Lo-swing Automatic Drilling and Centering Machine has the inbuilt features to provide all these requisites. It is designed for accurate centering on a continuous, high production basis, yet can be quickly and easily "changed-over" for short run jobs. Its 100% mechanical system provides positive, independent control of rapid traverse movements and drilling feeds. It has a fully automatic cycle and can be completely automated in a production line.

Write for your copy of Bulletin CS-54 which tells the whole story.

THIS IS WHAT MODEL CS WILL DO TO CUT COSTS ON TRACER AND AUTOMATIC LATHE PRODUCTION

- provide positive control of center depth to ± .001".
- accurately locate work piece to assure correct center depth at *both* ends.
- guarantee correct angle and perfect alinement of center holes.
- produce a smooth, cleanly-finished center hole capable of positive contact with the surface of the center. This is accomplished by a unique design of the feed cam which withdraws the center drill near the end of the feed stroke to clear chips . . . and then feeds a few thousandths at reduced rate for a final finish cut.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.


CENTER DRILLS HELD IN ADJUSTABLE CHUCKS
MACHINE CYCLE STARTING LEVER
AIR OPERATED EQUALIZING VISES
ACCESS TO SPEED CHANGE GEARS AND SPINDLE FEED CAM
ACCESS TO UNIVERSAL RAPID TRAVERSE CONTROL CAM AND FEED CHANGE GEARS
ADJUSTABLE CENTERING HEAD
RACK AND PINION FOR POSITIONING CENTERING HEAD
Lo-swing
FOOT VALVE FOR OPERATING VISES

Lo-swing MODEL CS AUTOMATIC CENTERING MACHINE

..NEWLY PRINTED BULLETIN

MR. TOOL ENGINEER:

May we help you reduce the man hours spent grinding your high speed steel and tungsten carbide cutters?

Faster grinding is one of the many advantages found in the use of Electro grinding wheels.

Electro wheels can take heavier cuts (for example they can remove .030″ of carbide per pass) . . give finer finishes and reduce or eliminate the use of diamond wheels.

Electro Wheels are different! Why not send for this newly printed Bulletin T-855?

ELECTRO REFRACTORIES & ABRASIVES CORPORATION

344 DELAWARE AVENUE
BUFFALO 2, N. Y.

Electro
SINCE 1919

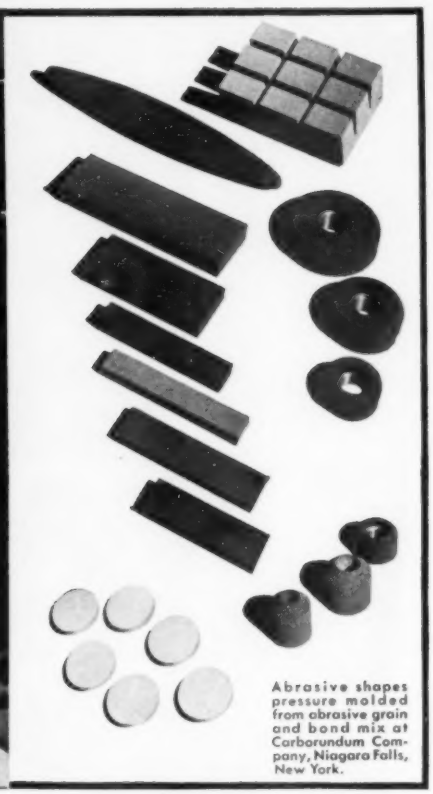
K-458
GRINDING WHEEL INSTITUTE MEMBER

Manufacturers VITRIFIED & RESINOID GRINDING WHEELS

Molding abrasives 50% faster with

DENISON *MULTIPRESS*®

with no downtime



Abrasive shapes pressure molded from abrasive grain and bond mix at Carborundum Company, Niagara Falls, New York.

PRODUCTION here has been increased 50% in molding of abrasive shapes. On operations requiring both molding and cutting, production is increased over 100%.

The operation is semi-automatic . . . the operator has only to remove the molded shapes.

The abrasive grain mix is hopper fed to a shuttle box. The shuttle box automatically indexes into position beneath the Multipress hydraulic ram. Ram pressure, set with hydraulic controls, is precisely duplicated on each stroke. Uniform density of abrasive grains is thus assured on every molded shape . . . with minimum operator training.

Molding dies are reset in a few minutes for different jobs.

What's your production problem? Compacting, riveting, staking, swaging, drawing . . . any operation calling for controlled ram pressure can be greatly improved with the Denison hydraulic Multipress. Have the Denison representative show facts and figures how you can benefit . . . now. Write

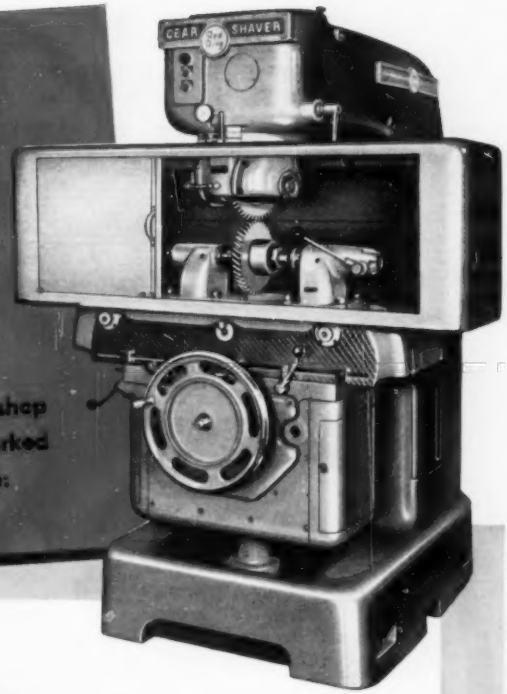
THE DENISON ENGINEERING COMPANY
1182 Dublin Road • Columbus 16, Ohio
A Subsidiary of American Brake Shoe Co.

HYDRAULIC PRESSES • PUMPS
MOTORS • CONTROLS

DENISON HydrOILics

The RED RING ALL-PURPOSE GEAR SHAVING MACHINE

The Red Ring Model GCI is the ideal job shop gear shaving machine because of its marked versatility. With this machine you can shave:



SPUR AND HELICAL GEARS TO 18" PD

INTERNALS TO 18" PD

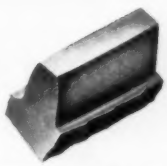
CAMSHAFT GEARS

CLUSTER GEARS

WIDE FACE GEARS

GEARS WITH LONG SHAFTS

LONG INVOLUTE SPLINES



STRAIGHT AND CROWNED TEETH

For high production work the GCI may be equipped with the Red Ring Automatic Differential Up and Down Feed, the Automatic Splash Guard Door and the Air Operated Tailstock to provide semi-automatic operation.

Bulletin 549-4 gives complete information and specifications. Write for it today.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

7282

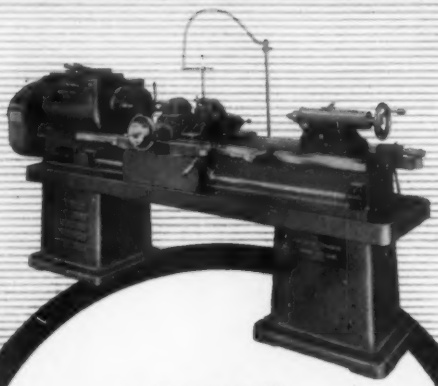
NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

The COULTER "L1"

AUTOMATIC THREADING LATHE



. . . is so versatile
that hundreds of diameters and
lengths of threads
can be produced on it,
without limitations . . .

FASTER – ACCURATELY – AUTOMATICALLY!

It could be your solution to
low cost threading!
GET the facts!

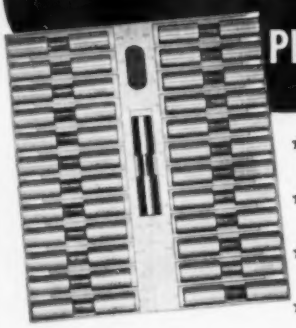
The *James Coulter* Machine Co.

448 Railroad Ave. Bridgeport 5, Conn.

Machine Tool BUILDERS Since 1896

USE READER SERVICE CARD; INDICATE A-1-260-1

CLOSER TOLERANCES with DELTRONIC TENTH PLUG GAUGES



★ Size variation by ten thousandths

★ Set of 25 costs approximately same as Go and No-Go gauge.

★ Available in increments of 1/64" from 1/8" to 1"

★ Hardness is Rockwell C62/C64

This new system of precision gauging provides one gauge of nominal size plus 12 gauges of increasingly larger sizes in .0001" increments and 12 gauges of decreasingly smaller sizes in increments of .0001". Each gauge is identified. It is the same size on both ends to double the life in usage.

For further information write Dept. D12.

DELTRONIC CORPORATION

1507 RIVERSIDE DRIVE • LOS ANGELES 31, CALIF.

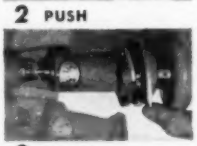
USE READER SERVICE CARD; INDICATE A-1-260-2

Now! *Anyone* can GRIND DRILLS

Quickly . . . . Accurately . . . . Easily

1 INSERT

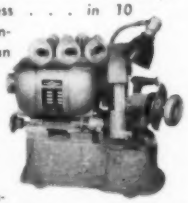
2 PUSH



3 TWIST

4 GRIND

The BLACK DIAMOND Drill Grinder restores a worn drill to like-new precision sharpness . . . in 10 *seconds!* Any inexperienced man (or woman!) is an expert grinder with this unit. Both lips ground at once . . . web-thinning equally simple! Pays for itself many times over!



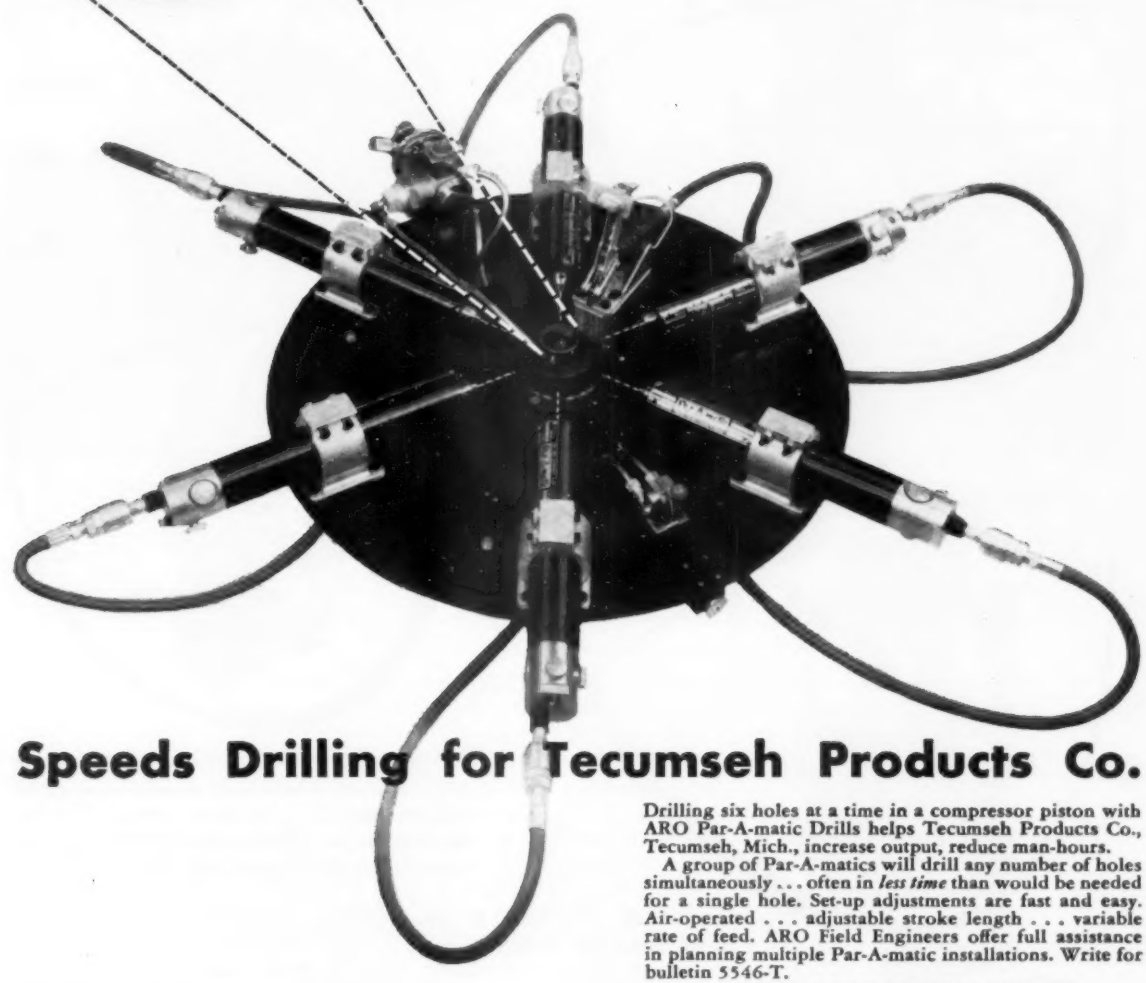
FREE BULLETIN

Get all the facts! 4 page illustrated bulletin gives complete story. *Write Today!*

BLACK DIAMOND SAW & MACHINE WORKS NORTH AVE. NATICK, MASS.

USE READER SERVICE CARD; INDICATE A-1-260-3

AUTOMATION WITH ARO PAR-A-MATIC DRILLS



Speeds Drilling for Tecumseh Products Co.

Drilling six holes at a time in a compressor piston with ARO Par-A-matic Drills helps Tecumseh Products Co., Tecumseh, Mich., increase output, reduce man-hours.

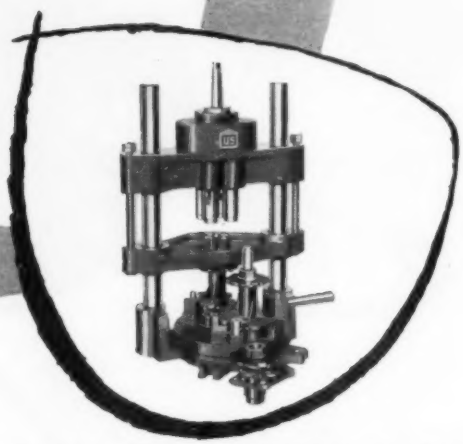
A group of Par-A-matics will drill any number of holes simultaneously . . . often in *less time* than would be needed for a single hole. Set-up adjustments are fast and easy. Air-operated . . . adjustable stroke length . . . variable rate of feed. ARO Field Engineers offer full assistance in planning multiple Par-A-matic installations. Write for bulletin 5546-T.

THE ARO EQUIPMENT CORPORATION
Bryan and Cleveland, Ohio
Aro of California, Los Angeles 7, California
Aro Equipment of Canada, Ltd., Toronto 15, Ontario
Offices in All Principal Cities

ARO **AIR TOOLS**
Also . . . AIR HOISTS . . .
LUBRICATING EQUIPMENT . . .
AIRCRAFT PRODUCTS . . .
GREASE FITTINGS

IT'S SAFER TO BUY
DRILL HEADS, FIXTURES and BUSHING PLATES
AS A COMPLETE PACKAGE

The 12-spindle unit shown below has a three-station hand-indexing table with three holding fixtures, complete with tool guide bushing plates.



Shown above is a drill head complete with boring bars with Carboloy-tipped cutters and Stellite wear strips. The indexing table has necessary holding fixtures with bushing guide plate.

The setup, left, has a two-position, hand-indexed fixture.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

US HEADS

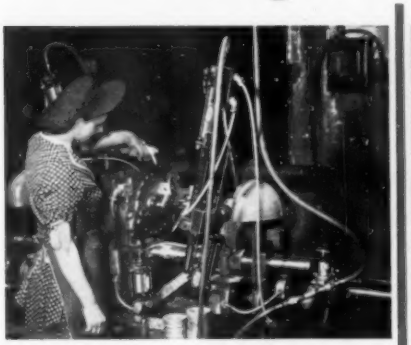
UNITED STATES DRILL HEAD COMPANY

616-618 BURNS STREET • CINCINNATI 4, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-262

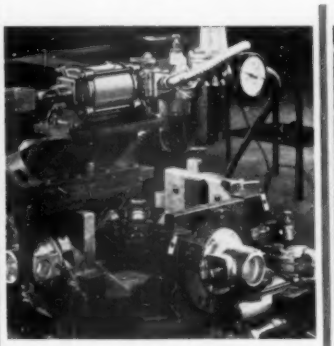
The Bellows AIR MOTOR

can help you make cost savings like these...



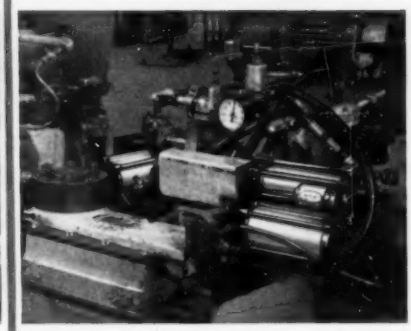
THREE PIECES FOR THE COST OF ONE

This special machine drills two die castings for vacuum cleaners at one time. Eight holes are drilled in one, thirteen in the other. Two Bellows Air Motors and two Drill Press Feeds do all the work — the operator only loads and unloads work pieces.



FINISHING OPERATIONS DONE 2½ TIMES FASTER

Two Bellows Air Motors and a Rotary Feed Table made the difference. This shop-built machine drills, bores, and faces aluminum gas regulator bodies.



DIRECT COSTS CUT FROM 17.4c TO 14.3c

Two Bellows Air Motors were installed on this turret lathe to control cross-slide and turret actions. Inside and outside diameters are finished and threads rolled on die cast temperature regulator parts.

Here are three actual cases of large cost reductions made in woodworking operations. In each case savings have been made by using one or more Bellows Air Motors . . . to replace slow, manual methods, or to combine separate, related operations into one efficient, economical process.

Such conversions are inexpensive and amazingly easy. For the Bellows Air Motor is a unique and different air cylinder. It is a power unit complete in itself — with all controls built-in. Advance and retract speeds are independently adjustable. Built-in 4-way valves, in a wide choice of electrical, pneumatic, or manual controls, provide the type of control needed for each job. Only one air connection is required, and that can be made with flexible hose. Bellows Air Motors are easily interlocked for automatic sequencing of work movements.

With these facts in mind, take a new look at your own shop. Wherever you see an operator's hand or foot moving a crank, wheel, lever, or pedal back and forth . . . back and forth, you see a high-cost operation. In nine out of ten such cases a Bellows Air Motor can do the job faster, better and far cheaper.

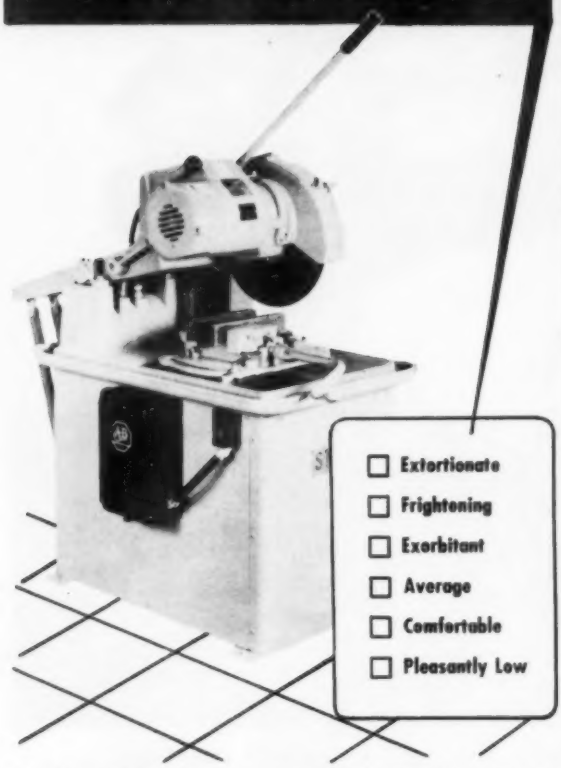
The Bellows Co.

AKRON 9, OHIO

WRITE TODAY FOR ILLUSTRATED BOOKLET, THE BELLOWS AIR MOTOR.
DEPT. TE-156

1307A-1

WHAT WERE YOUR CUT-OFF COSTS LAST YEAR?



Modern M75 by Stone Built to Reduce Costs ...because it's built to LAST!

Long, trouble-free service under the toughest conditions is assured by rigid construction of the M75. Modern engineering enables you to cut *faster* . . . average 2 to 4 seconds per sq. inch in ferrous, non-ferrous and non-metallic materials. Cut *cheaper* . . . increase your production by margins that add up to increased profits overall!

Machinery by Stone...a complete line...includes standard and exclusive features that will enable you to realize *all* the profit-potential on your particular operations.

Ask about the geared-in-head motor—an exclusive Stone feature—which delivers maximum power direct to the cutting edge for top efficiency. Our representative will gladly discuss your requirements with you. No obligation: simply write or phone.

"Cut-off machinery by Stone . . . represented in every major industry throughout the world."

STONE MACHINERY COMPANY, INC.
31 FAYETTE ST., MANLIUS, N. Y.

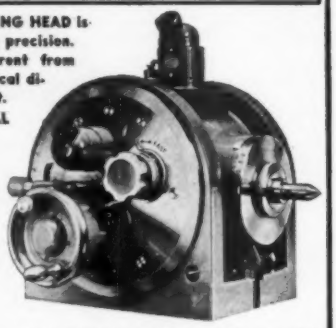
USE READER SERVICE CARD; INDICATE A-1-264-1

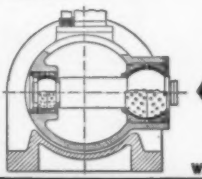
The New LEITZ Optical Dividing Head

A CUSTOMER SPEAKS:

"Without our Optical Dividing Head, we would not even attempt to make the critical indexing work nowadays necessary for things that fly, or mechanism that must control angular motions to hit targets at a distance, to measure degrees, minutes and seconds, to eliminate angular velocity errors and vibrations in quick running mechanisms, etc."

The LEITZ OPTICAL DIVIDING HEAD is the last word in indexing precision. Its construction is different from other optical and mechanical dividing heads on the market. A NEW DOUBLE SPHERICAL BALL BEARING, DOUBLE READING IN THE SAME EYEPIECE 180° APART, motor drive attachment and other features make the LEITZ an important aid required in any shop where precision is demanded.





The 2 spherical ends of the spindle are carried in hardened steel cups with several hundred small precision balls held in place by ball cages in such a way that each ball creates its own path. There is no play, either radially or axially, no oil film, no wear and a very large load capacity.

Write for Descriptive Bulletin --- Code GIPAD

Geo. SCHERR OPTICAL TOOLS, Inc.
200-TE LAFAYETTE STREET • NEW YORK 12, N.Y.

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GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills

Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS-HOAGLUND
Company
400 Main Street, Manchester, Conn.

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Q. What's new in grinding?

A. B-11 resinoid-bonded wheels —for many grinding jobs

Q. What's new about B-11 wheels?

A. Their great new resinoid bond, improved uniformity and balance, new "TOUCH of GOLD" performance-benefits

Q. What is the B-11 bond?

A. It's the latest Norton resinoid bond. Wheels made with it are excellent for snagging, disc grinding, heavy weld grinding, thread grinding, cam grinding, centerless grinding, roll and surface grinding.

Q. Why?

A. Because B-11 wheels are more uniform in structure, with better balance. As a result, they grind cooler and faster. And on portable machines they "hug that work" closer, with less vibration and bounce.

Q. What about those "Touch of Gold" benefits?

A. They're the direct result of the B-11 wheels' more efficient grinding action. In precision grinding this means improved surface finish, greater accuracy, more pieces per dressing. In rough grinding it means less operator-fatigue and longer wheel life. All these benefits add up to more profitable grinding for you.

Q. Any other advantages of B-11 wheels?

A. Many others. For example you get closest possible duplication. Hardness increments are evenly spaced throughout the entire grade scale. And B-11 wheels can be supplied in half-grade increments, making it even easier for you to choose exactly the right wheel for every job.

Q. Sounds fine— what about more information?

A. Your Norton Distributor will gladly give you the whole story on the new B-11 wheels. Or write us direct. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

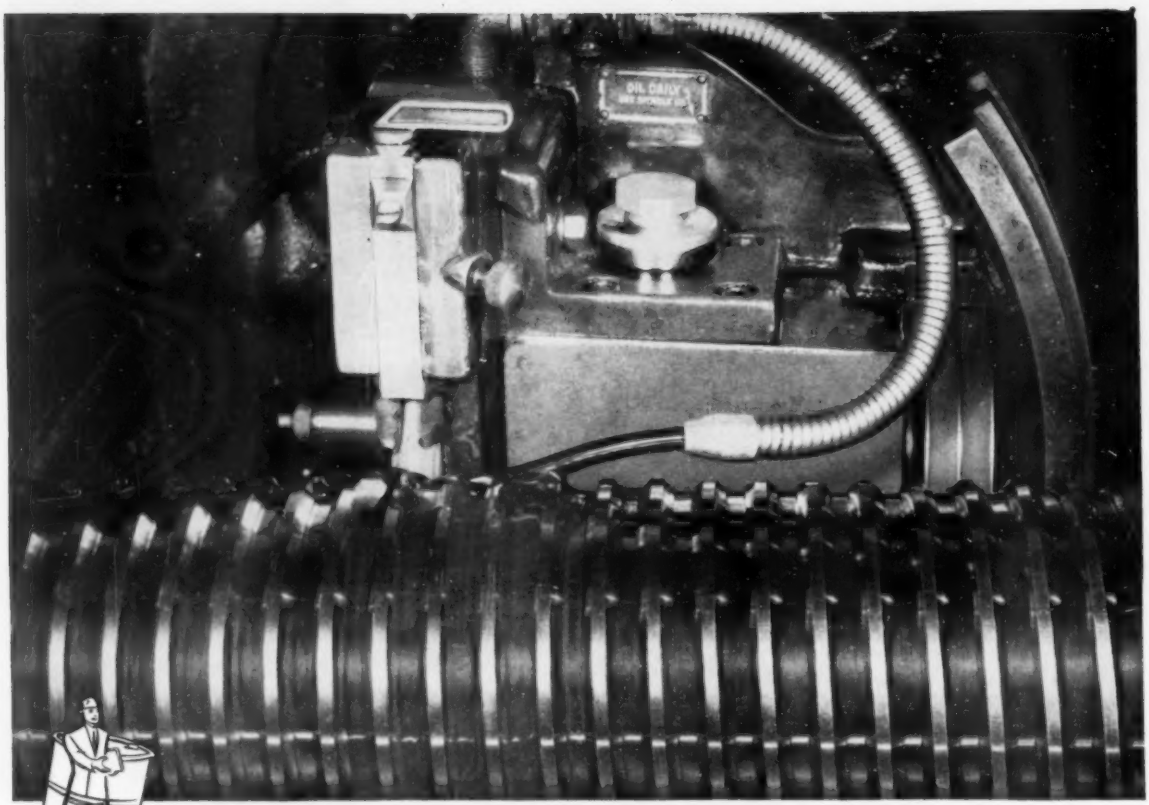
W-1778

NORTON

ABRASIVES

Making better products... to make your products better

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives Sharpening Stones • Pressure-Sensitive Tapes



Ask "the Man in the Barrel" to tell you how . . .

A Grinding Oil can *make* or *break* precision grinding jobs!

If you're using *just a coolant* or any oil that happens to be handy for those precision grinding jobs . . . it's costing you money!

A grinding oil can make or break a precision grinding job such as thread grinding, gear grinding and many types of form grinding. Grinding oils are usually classified as "hard-acting" or "soft-acting" depending on how they affect grinding wheel hardness. Grinding oil characteristics must be closely co-ordinated with wheel characteristics, speeds, feeds, and material machinability and hardness to obtain maximum performance.

When form grinding low hardness materials, where wheel form is important, a "hard-acting" oil helps to maintain proper wheel form by making the wheel act harder. As a result, greater wheel life is obtained and more accurate parts are produced.

When a high hardness material is being ground there is a tendency for the wheel to load-up and glaze. Such a condition is the cause of burnt work surfaces and heat checks, and is often encountered when grinding taps, gauges and other hardened parts. A "soft-acting" grinding oil will make the wheel act softer, opening up the wheel and exposing new abrasive grains to do the work.

Stuart's complete line of grinding oils have been chemically balanced and scientifically tested to meet the demands of various types of precision grinding operations. "The Man in the Barrel," your trained Stuart Representative, will be happy to assist you in selecting the proper grinding oil for your particular needs. Ask to have him call . . . and ask for a Stuart's Precision Grinding Oil Bulletin, too.

D. A. STUART OIL COMPANY, LTD.
2727-49 S. Troy Street, Chicago 23, Ill.

More than a "Coolant" is Needed

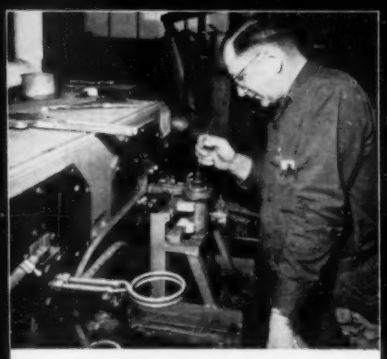
Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, Philadelphia and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

JACK & HEINTZ Saves $1.584 per hour...



Jack & Heintz Inc. silver brazes over 25 different parts on this 15 KW, 10,000 cycle TOCCO machine.

with TOCCO* Induction Brazing

Brazing Costs Down

When Jack & Heintz engineers switched from torch brazing to automatic induction, brazing cost of these inverter brush mounts fell from $.05 to $.006 each —a reduction of 83% in direct labor costs alone! Additional savings result because less cleaning is required after TOCCO, and fuel costs are much lower, too.

Brazing Production Up

While costs dropped, production on the part zoomed —from 40 to 360 brazed assemblies per hour. Furthermore, rejects and scrap, formerly high, are now negligible.

Versatility

The part shown is just one of over 25 parts, large and small, which alert J & H engineers have converted from old-fashioned brazing methods to modern, automatic TOCCO. Overall brazing costs (TOCCO brazing versus former methods used) are down 75%—brazing speed, up 100%.

* * *

If the manufacture of *your* product involves brazing, heat-treating, forging or melting of ferrous or nonferrous metals, don't overlook TOCCO as a sound method of increasing production, improving product quality and slashing costs.

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U.S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. G-1, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering".

Name_____

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Company_____

Address_____

City_____ Zone____ State_____

UDDEHOLM STOCKS THE TOOLMAKER'S STANDBY

SAE/JIC-01 (Carbon .90%, Manganese 1.20%, Silicon .25%, Chromium .50%, Tungsten .50%, Vanadium .20%) is a time-tested, oil-hardening, non-deforming analysis for general tool and die work. Uddeholm calls it UHB-46. It is available from stock in all the forms illustrated:

1. UHB-46 drill rods
2. UHB-46 flat ground stock
3. UHB-46 hot-rolled bars
4. UHB-46 special sections
5. UHB-46 hollow bars

And, we will deliver UHB-46 in special forgings.

With such a wide variety of sizes, shapes, and finishes, you can make all heat-treated components of a tool or die from one analysis and get them all from one source—Uddeholm.

From this source you also can get all the standard types of tool and die steels for hot and cold work, plus numerous special steels for making plastic molds, dies for cold-heading and dies for brass die casting. All of these types are available in an extremely wide range of sizes and shapes. Large stocks are carried in our strategically located warehouses in New York, Cleveland and Los Angeles.

Try Uddeholm Service and Uddeholm Swedish quality on your next tool steel order. Or, get acquainted with our stocks and grades by sending for the latest Uddeholm Tool Steel Stock List.

UHB

UDDEHOLM COMPANY OF AMERICA, INC.

Tool and Die Steels
Specialty Strip Steels

Offices and Warehouses

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Cleveland: 4540 East 71st Street, DIamond 1-1110
Los Angeles: 5037 Telegraph Road, ANgelus 2-5121

District Representatives

CHICAGO: Frank J. Mackin, Leroy E. Marshall, 55 East Washington, STate 2-1649
DETROIT: Warren H. Nugent, 17304 Lahser Road, KEnwood 5-6340

In Canada: Uddeholm (Canada) Ltd.
35 Coronet Road, Toronto 18, BElmont 3-3235

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(*by actual report of exhibitors)

including 453 487

TOOLING CHAMPION 1956

BLUE RIBBON TOOLING CHAMPIONS

at the

1956 ASTE INDUSTRIAL EXPOSITION

International Amphitheatre
Chicago, Illinois • March 19-23

sponsored by

AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVENUE • DETROIT 38, MICHIGAN

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Such complete all-industry conferences on advancements in tooling and production methods held anywhere in the world! Of vital interest . . . presented by leading experts in research and development who will be available for questions about your own operations . . .

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  (latest information on the use of diamonds in industry . . . actual diamond workshop in action,co-sponsored by Armour Research Foundation)
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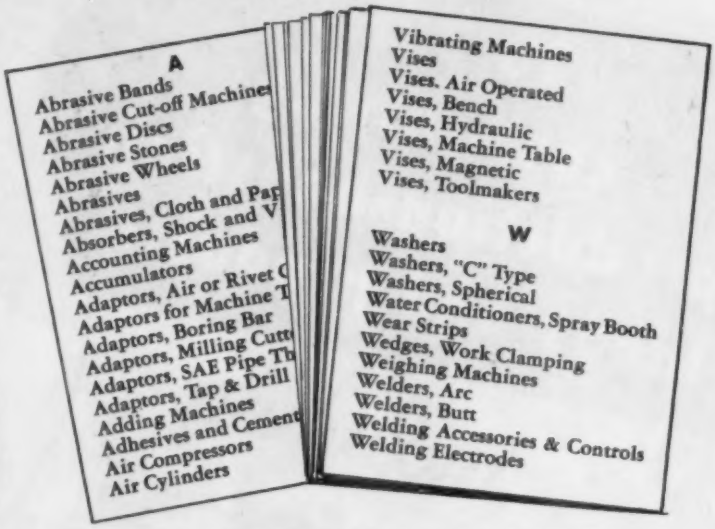

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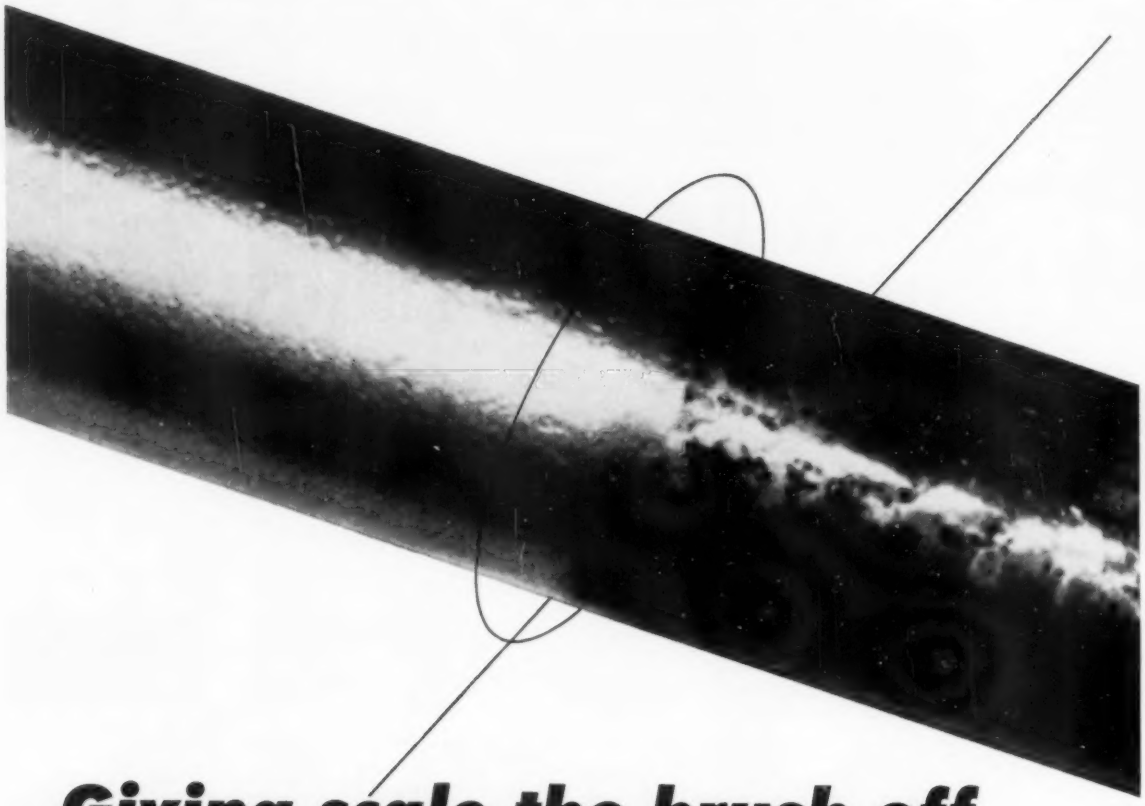
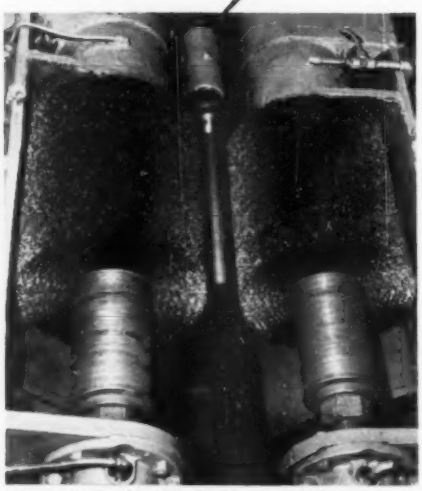


Giving scale the brush off



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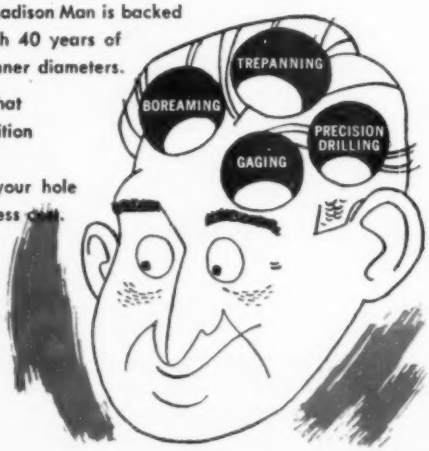

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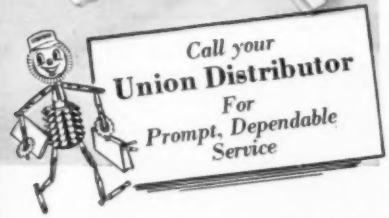

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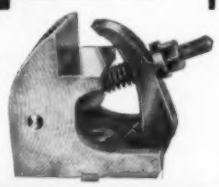

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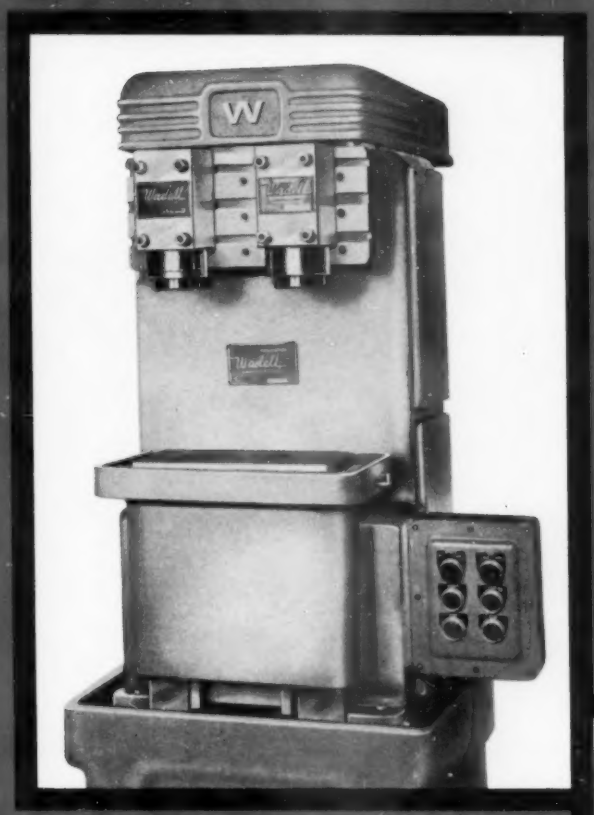

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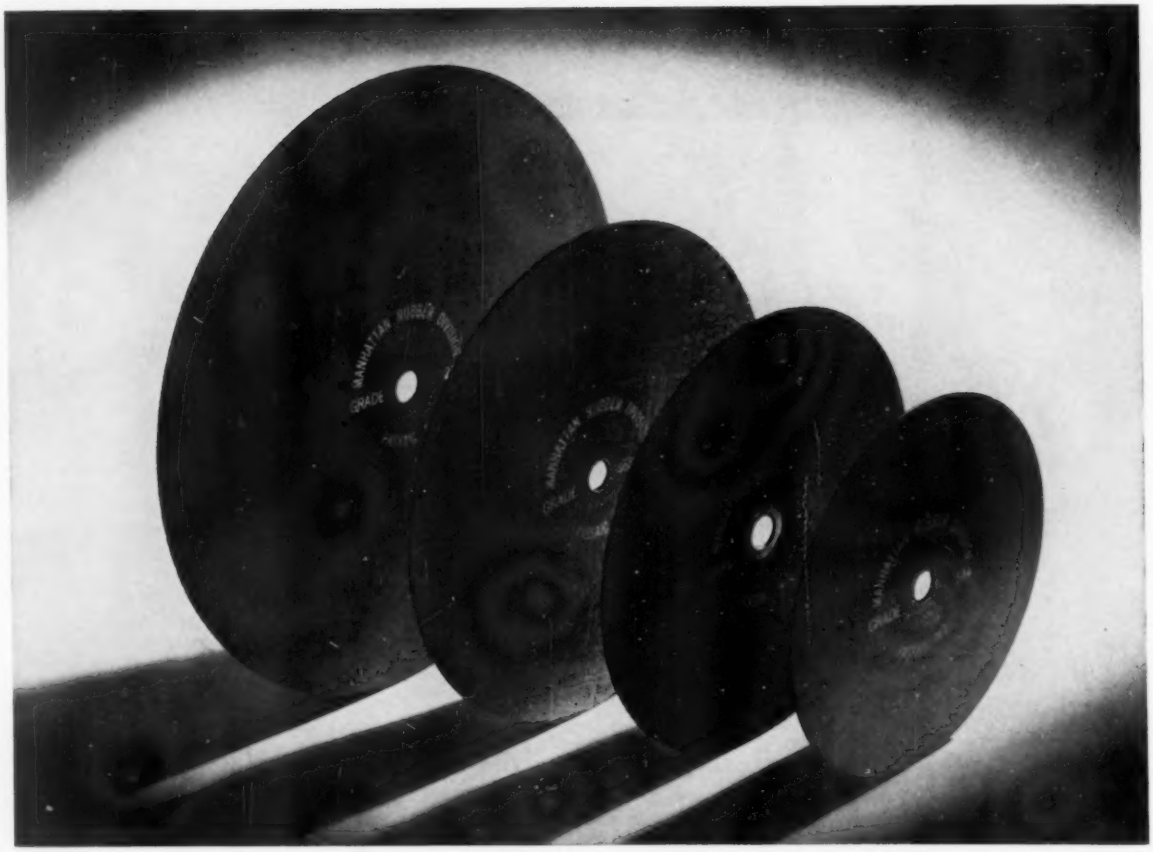

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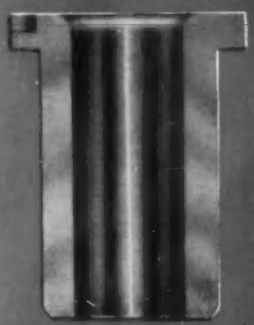

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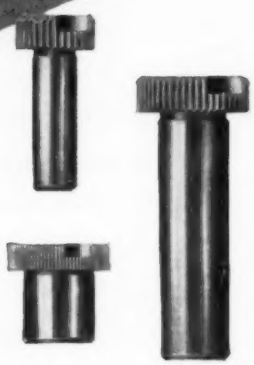

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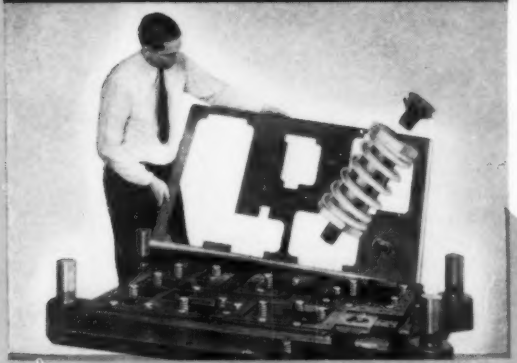

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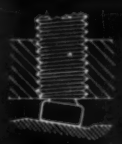
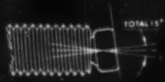


- Screw torque absorbed by pad—not the work piece.

- Unique ball-joint construction provides extremely smooth angle adjustment and rotation of pad.



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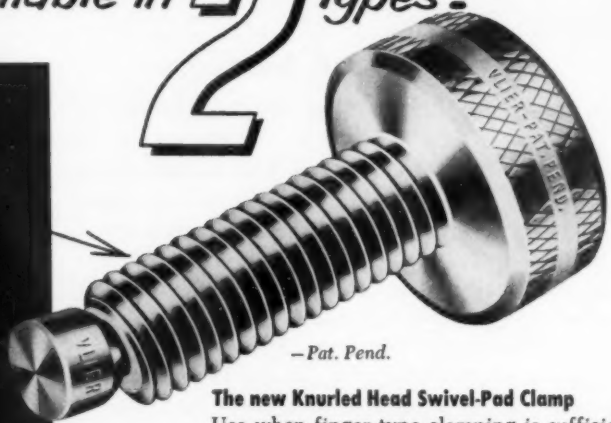

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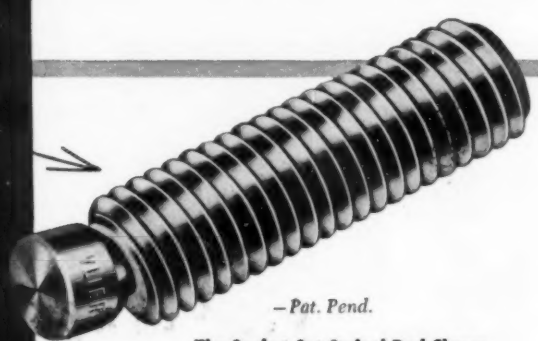

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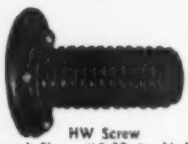

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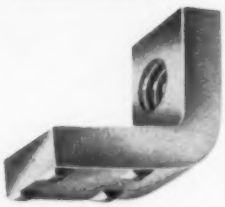
PG Pin
Body Dia. .117 to .335



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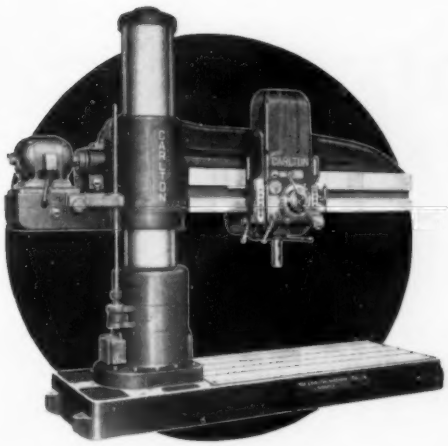

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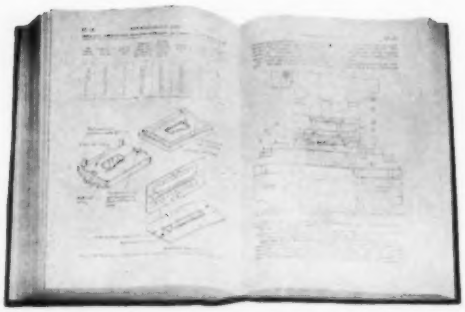

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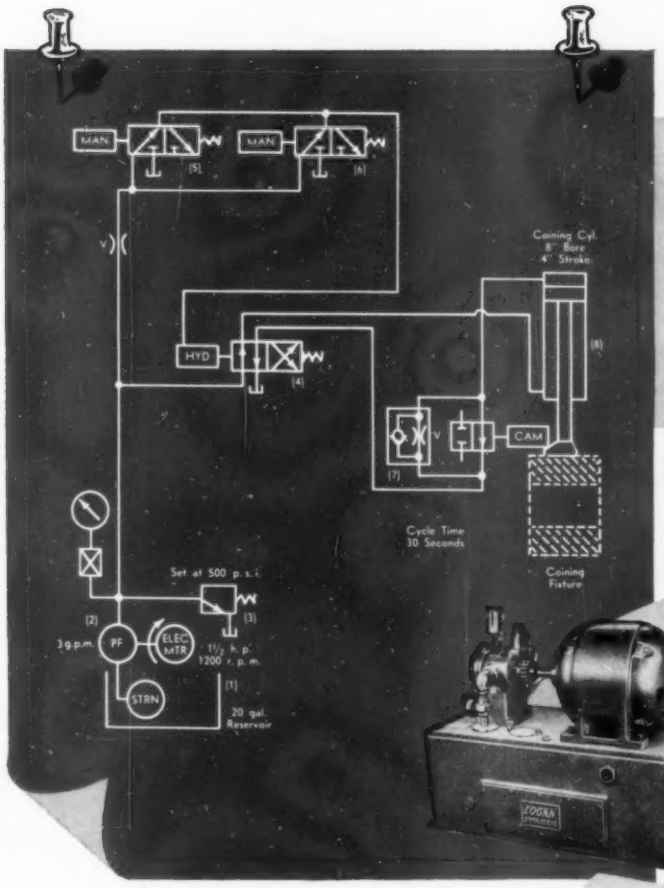

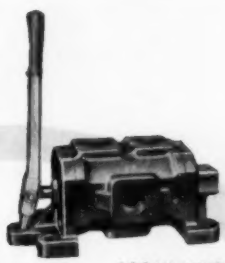

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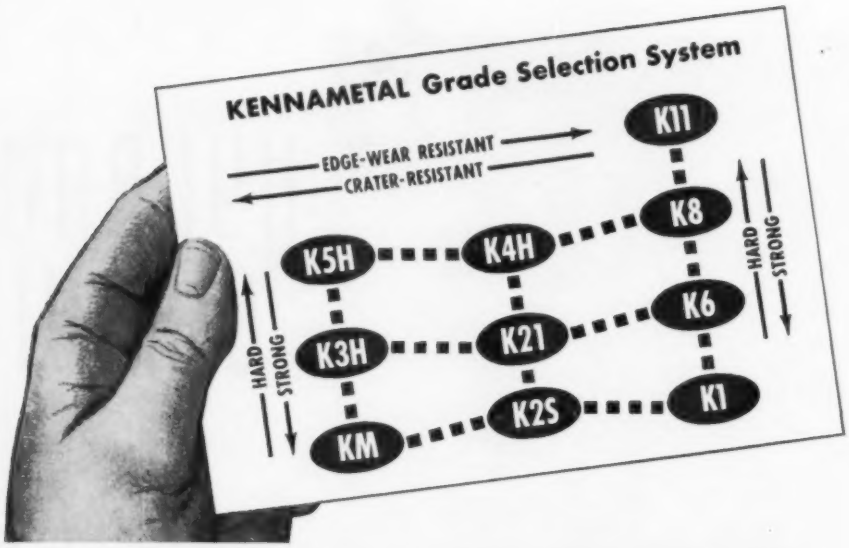

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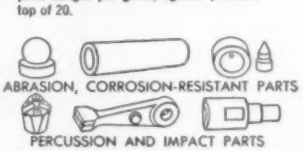

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MATERIAL: Die-Cast Aluminum

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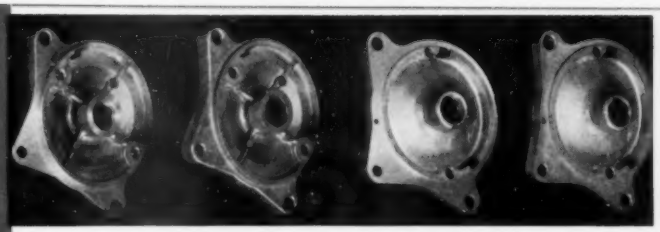

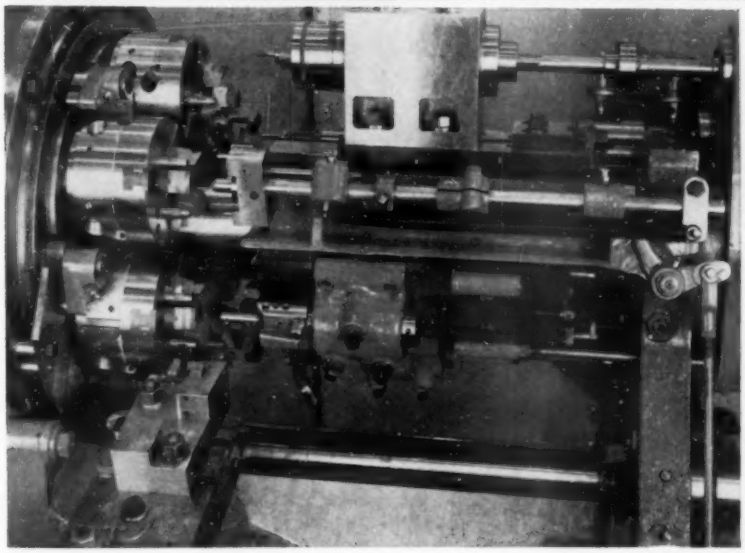

OPERATIONS

Back face and chamfer one end of hub, using a recessing tool. Bore center hole concentric with flange diameters with high speed boring head. Face both sides of flange and turn the diameters concentric with hole. Bore a small hole off center with high speed boring head and tap two holes. The work is located in proper position and held stationary while the off-center hole is bored and the two holes tapped.

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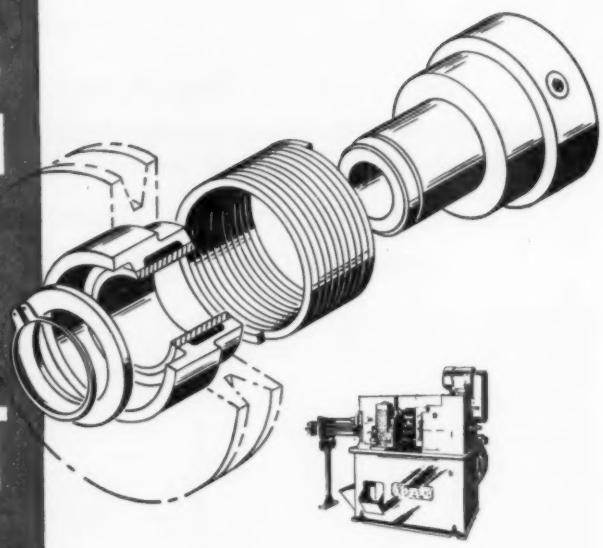

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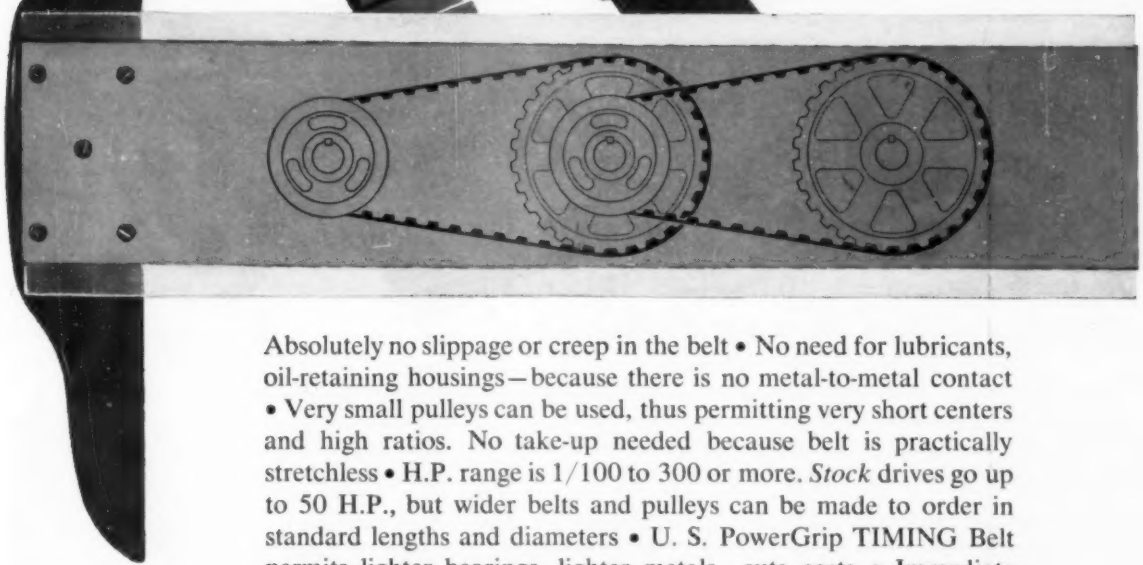

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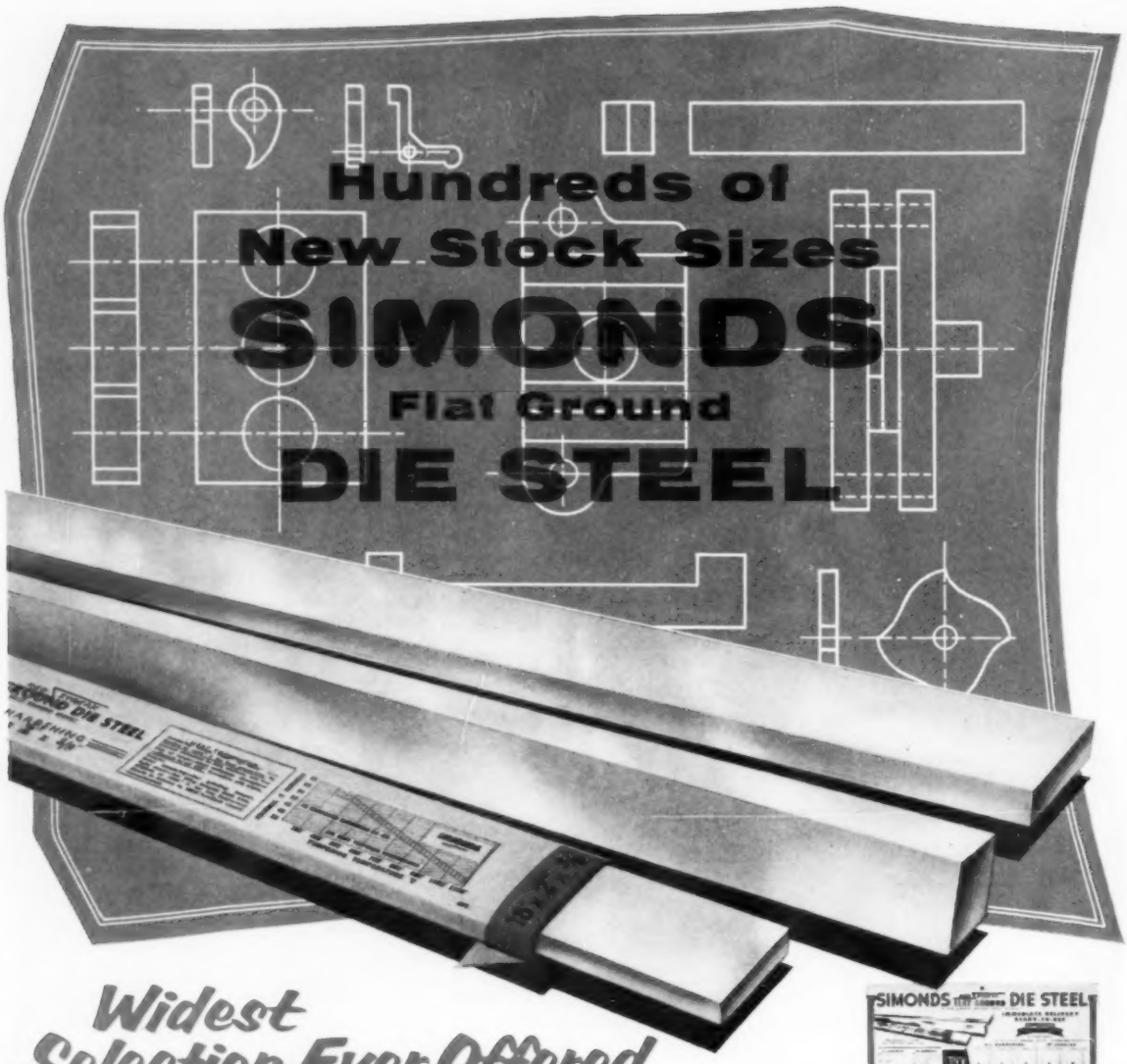

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This index is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

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Barber-Colman Co.—Apr., Aug.
Bullard Co., The—May, Sept., Oct.
Comtor Co.—Aug.
Coulter, James, Machine Co., The—Jan.
Cushman Chuck Co.—Aug.
Danly Machine Specialties, Inc.—Aug.
Delta Power Tool Division, Rockwell Mfg. Co.—Apr., Aug., Oct., Dec.
DeVlieg Microbore Co.—Jan., May
Elgin Tool Works, Inc.—Aug., Sept.
Gisholt Machine Co.—Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Hardinge Brothers, Inc.—Mar., Apr., May, June, Aug., Nov., Dec.
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Lehigh Foundries, Inc.—Jan., Feb., Apr., June
Levin, Louis & Son, Inc.—Feb., Apr., Aug.
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Logan Engineering Co.—Mar., Apr., May, Oct., Nov.
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New Britain Machine Co., The—Feb., Oct.
Potter & Johnston Co., Pratt & Whitney—May, Sept.
Pratt & Whitney Co.—July, Sept.
Seneca Falls Machine Co.—Feb., Mar., May, July, Aug., Sept., Oct., Nov.
Sheldon Machine Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Sidney Machine Tool Co.—Feb., May, Aug.
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Ex-Cell-O Corp.—Feb., Apr., May, July, Sept., Oct.
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Greenlee Bros. & Co.—May
Heald Machine Co., Subsidiary The Cincinnati Milling Machine Co.—Jan., Feb., Apr., June, Nov.
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Portage Double-Quick Tool Co.—Oct.
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Wickes Brothers—Sept.

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Cincinnati Shaper Co.—Jan., Apr., July, Sept., Dec.
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Sheldon Machine Co.—Sept.

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Bellows Co., The—Mar.
Black Drill Co.—Feb.
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Carlton Machine Tool Co., The—Jan., Feb., Mar., Apr., May, Aug., Nov., Dec.
Delta Power Tool Division, Rockwell Mfg. Co.—Feb., June
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Jones & Lamson Machine Co.—Sept.
Kearney & Trecker Corp.—Mar., Oct.
Keller Tool Division, Gardner-Denver Corp.—Mar., June
Kingsbury Machine Tool Co.—Mar., June, Sept.
Krueger-Barnes Corp.—Apr., Sept.
Levin, Louis & Son, Inc.—May, Sept., Nov.
Madison Mfg. Co.—Mar., Sept.
Michigan Drill Head Co.—Feb., Mar., May
Moline Tool Co.—July, Dec.
Morris Machine Tool Co.—June, July, Aug., Sept., Oct.
Motch & Merryweather Machinery Co., The—Aug.
National Automatic Tool Co., Inc.—Dec.
Rehnberg-Jacobson Co.—Jan., Feb., Apr., May, June, July, Oct.
Seibert & Son, Inc.—May, Sept.
Seneca Falls Machine Co.—Aug., Sept.
Sibley Machine & Foundry Corp.—Jan., Apr., Oct.
Snow Mfg. Co.—Jan., Mar., June, Dec.
Taylor Dynamometer and Machine Co.—Mar., Apr., Oct.
U. S. Drill Head Co.—Jan., Feb., Mar., Apr., May, June, Sept., Oct., Nov., Dec.
Walker-Turner Division, Kearney & Trecker Corp.—Dec.
Zagar Tool, Inc.—July, Oct., Dec.

GEAR CUTTING & FINISHING

Airborne Accessories Corp.—July
Barber-Colman Co.—Jan., Feb., Mar., May, June, July, Sept., Oct.
Cosa Corp.—Jan.
Cross Co., The—Feb., Apr., June, Oct., Dec.
Fellows Gear Shaper Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Gould & Eberhardt, Inc.—Sept.
Krueger-Barnes Corp.—July
Lees-Bradner Co.—Mar., July, Sept., Nov.
Michigan Tool Co.—Mar., May, July, Aug., Sept., Nov.
National Broach & Machine Co.—Sept., Oct., Nov.
Potter & Johnston Co., Division Pratt & Whitney Co., Inc.—Oct.
Russell, Holbrook & Henderson, Inc.—Jan., Feb., Mar., May, July

TAPPING & THREADING

Besly-Welles Corp.—May, June
Black Drill Co.—Feb.
Blake, Edward, Co.—Nov.
Bodine Corp., The—Oct., Dec.
Buhr Machine Tool Co.—Mar.
Cleveland Tapping Machine Co., The, Subsidiary of Automatic Steel Products Co.—Jan.
Commander Mfg. Co.—Mar.
Consolidated Machine Tool Corp., Modern Tool Works Division—Jan., Feb., Aug., Sept.
Coulter, James, Machine Co., The—Jan., Mar., May
Eastern Machine Screw Corp., The—Apr., May, June, Aug., Sept.
Erickson Tool Co.—Nov.
Errington Mechanical Laboratory, Inc.—Mar., May, Sept.
Ettco Tool Co., Inc.—Apr., May, Oct., Dec.
Ex-Cell-O Corp.—Sept.
Foote-Burt Co., The—May, Nov.
Greenfield Tap & Die Corp., Geometric Tool Company Division—Mar., Sept.
Greenlee Bros. & Co.—May
Hartford Special Machinery Co., The—Feb., Sept.
Howe & Fant, Inc.—Feb., May, Oct.
Ingersoll-Rand, Inc.—Jan.
Jarvis Corp.—Sept., Nov.
Jones & Lamson Machine Co.—Feb., Mar., Apr., May, June, Sept.
Kaufman Mfg. Co.—Jan., Mar., May, July, Sept., Nov.
Kearney & Trecker Corp.—Mar., Oct., Nov.
Kingsbury Machine Tool Corp.—Mar., June, Sept., Dec.
Krueger-Barnes Corp.—Sept.
Landis Machine Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Lees-Bradner Co.—May
National Acme Co., The—Oct., Dec.
National Automatic Tool Co.—Dec.
Procunier Safety Chuck Co.—Mar.
Reed Rolled Thread Die Co.—Feb., Apr., June, Sept., Nov.
Rehnberg-Jacobson Co.—Jan., July, Oct., Dec.
Seibert & Son, Inc.—July
Seneca Falls Machine Co.—Aug.
Sheffield Corp.—May
Snow Mfg. Co.—Jan., Mar., June, Dec.
Tapmatic Corp.—May
U. S. Tool Co., Inc.—Sept.
Wade Tool Co.—Apr.

BROACHING

Acme Broach Corp.—Mar., May
American Broach & Machine Co., Division of Sundstrand Machine Tool Co.—Jan., Feb., Mar., Apr., June, July, Aug., Sept., Oct., Nov., Dec.
Colonial Broach & Machine Co.—Feb., Apr., June, Aug., Oct., Dec.
Continental Tool Works Division, Ex-Cell-O Corp.—Mar., Nov.
Detroit Broach Co.—Feb., Apr., Aug., Oct., Dec.

Ex-Cell-O Corp., Continental Tool Works Division—Mar., Nov.
Foote-Burt Co., The—Jan., Feb., Mar., Apr., June, Aug., Sept., Dec.
Lapointe Machine Tool Co., The—Jan., Feb., Mar., Apr., June, July, Aug., Sept., Oct., Nov., Dec.
National Broach & Machine Co.—Feb., Mar., Apr., May, June, July, Aug., Dec.
Pioneer Broach Co.—Mar.
Pope Machinery Corp.—Oct.

MILLING

American SIP Corp.—Mar.
Axelson Mfg. Co., Division of U. S. Industries, Inc.—Oct., Dec.
Barker Eng. Co.—Feb., June
Barnes, W. F. & John, Co.—Feb.
Bodine Corp., The—Oct.
Brown & Sharpe Mfg. Co.—Sept., Nov.
Buhr Machine Tool Co.—Jan.
Bullard Co., The—Mar., Aug.
Coulter, James, Machine Co., The—July
DeVlieg Machine Co.—Apr., Oct., Dec.
Erickson Tool Co.—July, Nov.
Gorton, George, Machine Co.—Mar., May, Sept.
Greaves Machine Tool Division, J. A. Fay & Egan Co.—Mar., May, July, Aug., Sept., Nov.
Hardinge Brothers, Inc.—Sept.
Kearney & Trecker Corp.—Jan., Feb., Apr., July, Aug., Sept., Nov., Dec.
Kempsmith Machine Co.—Sept., Nov.
Knight, W. B., Machinery Co.—Feb., Apr.
Krueger-Barnes Corp.—Apr.
Lees-Bradner Co.—June
M.B.I. Export & Import, Ltd.—Mar., Apr.
Master Mfg. Co.—Mar.
Morey Machinery Co.—Sept.
Motch & Merryweather Machinery Co., The—Aug., Oct., Dec.
Pope Machinery Corp.—Jan., Apr., July
Portage Double-Quick Tool Co.—Dec.
Pratt & Whitney Co., Inc.—Jan., July, Aug., Sept., Dec.
Precise Products Corp.—Aug.
Rehnberg-Jacobson Mfg. Co.—Feb., July
Sheldon Machine Co.—Sept.
Sundstrand Machine Tool Co.—Jan., Sept., Nov.
U. S. Burke Machine Tool Division—Mar.

GRINDING, HONING, LAPPING, BURNISHING

Anocut Engineering Co.—June
Arter Grinding Machine Co.—Sept., Oct., Nov., Dec.
Bachmann, Eric R., Co., Inc.—June
Barber-Colman Co.—Aug.
Barnes Drill Co.—Jan., May, Sept., Nov.
Black Diamond Saw & Machine Works—May, July, Sept., Nov.
Blake, Edward, Co.—Mar., Apr., May, Aug., Sept.
Blanchard Machine Co.—Feb., Apr., June, Aug., Oct., Dec.
Boyar-Schultz Corp.—Mar.
Brown & Sharpe Mfg. Co.—Feb., Sept., Oct.
Consolidated Machine Tool Co.—Mar., Apr., July, Oct., Nov., Dec.
Crane Packing Co.—Jan., Mar., May, Aug., Oct., Nov.
Crystal Lake Grinder Co.—Mar.
Deakin, J. Arthur, & Son—Dec.
Detroit Reamer & Tool Co.—Mar., Aug.
DoALL Co.—Mar., Sept.
Dumore Co., The—Mar.
Elox Corporation of Michigan—May, June, Sept.
Engelberg-Huller Co., Inc., The—Mar., May, July, Sept., Oct., Nov., Dec.
Ex-Cell-O Corp.—Apr., July
Foote-Burt Co., The—Sept.
Foster Engineering Corp.—May
Frauenthal Division, The Kaydon Engineering Corp.—Feb., Apr., June, Aug., Oct., Nov.
Gisholt Machine Co.—Mar., Aug., Sept., Oct., Dec.
Hammond Machinery Builders, Inc. — Jan., Mar., May, July, Sept., Nov.
Heald Machine Co., Subsidiary The Cincinnati Milling Machine Co.—Mar., May, July, Aug., Sept., Oct., Dec.
Hill Acme Co., The—Mar., Sept., Nov.
Hirschmann, Carl, Co., Inc.—Mar.
Ingersoll Milling Machine Co., The—Jan.
M-B Products—Nov.
Madison Mfg. Co.—Mar., Sept.
McDonough Mfg. Co.—Mar., May, July, Sept., Nov.
Metal Carbides Corp.—May
Micromatic Hone Corp.—Jan., Mar., May, July, Sept., Nov.
Moline Tool Co.—Dec.
Moore Special Tool Co.—Sept.
Norton Co.—Feb., Apr., June, Aug., Sept., Nov., Dec.
Parker-Majestic, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Pope Machinery Corp.—Jan., Feb., Mar., Apr., June, July, Oct., Nov.
Pratt & Whitney Co., Inc.—Jan., Aug., Sept., Dec.
Precise Products Corp.—Dec.
Rankin Brothers, Inc.—Mar., Apr.
Reid Brothers Co., Inc.—Mar., Sept.
Rotor Tool Co.—Feb., Oct.
Scully-Jones & Co.—Mar.
Sheffield Corp., The—Sept.
South Bend Lathe Works—May
Taft-Peirce Mfg. Co., The—Aug.
Thompson Grinder Co.—Feb., Apr., June, Sept., Nov.
Vulcan Tool Co.—Jan., Feb., Mar., Apr., May, June, Sept., Oct., Nov., Dec.

CUTOFF AND FILING

Armstrong-Blum Mfg. Co.—Jan., Mar., Apr., May, June, Aug., Sept., Nov.
Campbell Machine Division, American Chain & Cable Co.—Feb., Apr., June, Aug., Oct.
DoALL Co.—Jan., Feb., May, Oct., Nov.
Galland-Henning Mfg. Co.—Dec.
Heller Machine Co.—Aug., Sept., Oct., Nov., Dec.
Kling Bros. Engineering Works—Jan., May, July, Sept.
Lobdell United Division, United Engineering and Foundry Co.—Oct.
Mettler Machine Co.—May
Motch & Merryweather Machinery Co., The—June
O'Neil-Irwin Mfg. Co.—Dec.
Stone Machinery Co., Inc.—Apr., May, July, Sept., Nov.

TRANSFER MACHINES

Baker Brothers, Inc.—Feb., Apr., Oct., Dec.
Barnes, W. F. & John, Co.—Feb.
Baush Machine Tool Co.—Mar., Aug.
Bodine Corp., The—Nov.
Buhr Machine Tool Co.—May, July, Sept., Nov.
Cross Co., The—Jan., Mar., May, July, Aug., Sept., Nov.
Foote-Burt Co., The—Oct.
Hartford Special Machinery Co., The—Apr.
Johnson, S. C. & Sons, Inc.—Feb.
Kearney & Trecker Corp.—May, Sept.
Liberty Tool & Die Corp.—May
Moline Tool Co., The—Feb., Sept.
Motch & Merryweather Machinery Co., The—Feb., Apr.
Rehnberg-Jacobson Mfg. Co.—Nov.
Seneca Falls Machine Co.—Sept.
Snyder Tool & Engineering Co.—Jan., Mar., May, July, Sept., Nov., Dec.

AUTOMATIC MACHINES

Baird Machine Co.—Jan., Mar., Sept., Nov.
Brown & Sharpe Mfg. Co.—July, Sept.
Bullard Co., The—Feb., Aug., Sept.
Cleveland Tapping Machine Co., Subsidiary of Automatic Steel Products Co.—Jan.
Cone Automatic Machine Co.—Apr., June, Aug., Oct., Dec.
Cosa Corp.—Mar.
Detterbeck, Geo. L., Co.—Apr., June, Aug., Oct., Dec.
Greenlee Bros. & Co.—Jan., Feb., Mar., Apr., July, Sept., Oct., Nov.
Hirschmann, Carl, Co., Inc.—Mar.
National Acme Co., The—Feb., Apr., June, Aug.
National Automatic Tool Co., Inc.—May, June, July, Aug., Sept., Oct.
New Britain Machine Co., The—June, Sept.
Potter & Johnston, Division of Pratt & Whitney Co., Inc.—Jan., Mar., July, Sept.
R and L Tools, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Russell, Holbrook & Henderson, Inc.—Apr., June, Aug., Sept., Oct., Nov., Dec.
Sundstrand Machine Tool Co.—Mar.

MACHINE TOOLS AND ACCESSORIES

WORKHOLDERS

Almond, T. R., Mfg. Co.—June
American Machine & Foundry Co., Wahlstrom /Float-Lock Division—Feb., Mar., Sept., Oct., Dec.
American Positive Grip Vise Corp.—Feb., Apr., June, Aug., Oct., Dec.
Armstrong Bros. Mfg. Co.—Jan., Feb., June
Balas Collet Mfg. Co.—Jan., Mar., May, Sept., Dec.
Benco Collet Mfg. Co.—Feb., Apr., Aug., Oct.
Black Drill Co.—June
Brown & Sharpe Mfg. Co.—Apr., Sept.
Buck Tool Co.—Mar., Apr., June, Aug., Oct., Nov.
Cardinal Machine Co.—Mar., May, Aug.
Case-Maul Mfg. Co.—May, June, July, Aug., Sept., Oct.
Concentric Tool Corp.—Jan., Mar., May, July, Sept., Nov.
Crodian & Co.—Mar.
Cushman Chuck Co.—Mar., Apr., June, Sept., Nov.
Dakon Tool & Machine Co.—Jan., Feb.
Danly Machine Specialties, Inc.—Jan.
Detroit Reamer & Tool Co.—Mar., Apr., Oct.
Detroit Stamping Co.—Jan., Mar., May, July, Sept., Nov.
Erickson Tool Co.—Jan., Sept.
Glenzer, J. C., Co.—Dec.
Hardinge Brothers, Inc.—Jan., Feb., Mar., July, Oct.
Heinrich Tools, Inc.—Feb.
Horton Chuck—Feb., Mar., Apr., June, July, Sept.
Ideal Industries, Inc.—Mar., May, July, Sept., Nov.
J & S Tool Co., Inc.—Mar.
Jacobs Mfg. Co.—Mar., June, Oct., Dec.
Jones & Lamson Machine Co.—Sept.
Lapeer Mfg. Co.—Feb., Mar., June, Sept.
Lee, K. O., Co.—Jan., Mar., Apr.
Lodding, Inc.—Jan., Mar., May, Sept., Nov.
Melin Tool Co., Inc.—Aug.
Morton Machine Works—Jan.
Pioneer Tool Engineering, Inc.—Aug., Sept.
Production Aids Co.—Mar.
Ready Tool Co.—Feb., Mar., Apr., Oct.
Robbins, Omer E., Co.—Apr., Oct.
S-P Mfg. Corp.—Jan., Mar., Sept.
Seibert & Son, Inc.—Mar.
Skinner Chuck Co.—Jan., Apr., Aug., Oct., Dec.
Snow Mfg. Co.—June
Standard Parts Co.—Jan., Feb., Mar., Apr., May, June, July
Sutton Tool Co.—Aug., Dec.
Taft-Peirce Mfg. Co.—Aug.
Universal Engineering Co.—May
Vlier Engineering, Inc.—June
Vulcan Tool Co.—Feb.
Walker, O. S., Co., Inc.—Jan., Mar., May, Sept., Nov.
West Point Mfg. Co.—Feb., Apr., June, Aug., Oct., Dec.
Williams, S. J., Precision Tool Kits, Inc.—May
Wilton Tool Mfg. Co.—Mar., May, July, Sept., Nov.
Woodworth, N. A., Co.—Mar., Nov.
Zagar Tool, Inc.—Jan., Feb., Mar., June, Nov.

TOOLHOLDERS AND GUIDE

Accurate Bushing Co.—May, Oct.
Ace Drill Bushing Co., Inc.—Feb., Apr., June, Aug., Oct., Dec.
Acme Industrial Co.—Jan., July, Sept.
Aloris Tool Co.—Mar.
American Drill Bushing Co.—Jan., Feb., Mar., May, June, July, Aug., Sept., Oct., Nov., Dec.
American Machine & Foundry Co., Wahlstrom /Float-Lock Division—June
Apex Tool & Cutter Co.—Feb., July
Armstrong Bros. Tool Co.—Jan., Apr., Sept., Oct., Nov.
Brookfield, Inc.—May, June, Sept., Nov.
Burg Tool Mfg. Co.—Feb., Apr., June, Aug., Oct., Dec.
Carboloy, Department of General Electric—Sept., Oct., Dec.
Colonial Bushings, Inc.—Jan.
Danly Machine Specialties, Inc.—July
Davis Boring Tool Division, Giddings & Lewis Machine Tool Co.—May
Detroit Reamer & Tool Co.—Mar.
Erickson Tool Co.—May, Sept.
Ex-Cell-O Corp.—Feb., Aug., Nov., Dec.
Gatco Rotary Bushing Co.—Jan., Mar., July, Aug., Sept., Nov.
Glenzer, J. C., Co.—Mar., June, Oct.
Hardinge Brothers, Inc.—Mar.
Hi-Shear Rivet Tool Co., The—Mar., June, Oct.
Ideal Industries, Inc.—Apr.
Jacobs Mfg. Co.—Feb., Aug.
Jarvis Corp.—Oct.
Jergens Division, Donley Products, Inc.—Jan., May
Kennametal, Inc.—Jan., Mar., Nov., Dec.
Lamina Dies & Tools, Inc.—June, Aug., Oct., Dec.

Lee, K. O., Co.—Feb., May, July, Aug., Sept., Oct., Nov., Dec.
Magna Driver Corp.—Jan.
Mallory, P. R., & Co., Inc.—Jan., Oct., Nov., Dec.
Metal Carbides Corp.—Dec.
Meyers, W. F., Co.—Jan., May, July, Sept., Oct., Nov.
Moline Tool Co.—May
Newcomer Products, Inc., Greenleaf Corp.—Sept.
Portage Double-Quick Tool Co.—Apr., June, Aug.
Scully-Jones & Co.—Feb., Mar., Apr., May, June, Sept., Oct., Nov., Dec.
Seaboard Steel Company of America—Apr.
Seibert & Son, Inc.—Nov.
Skinner Chuck Co.—Jan., June
Standard Tool Co.—Dec.
Sturdy Broaching Co.—Mar., June, Sept., Dec.
Sutton Tool Co.—Apr.
Titan Tool Co.—Sept., Nov.
Universal Engineering Co.—Jan., Mar., May, July, Sept., Nov.
Vascoloy-Ramet Mfg. Corp.—Jan., Mar., Apr., May, June, July, Sept., Oct., Nov., Dec.
Waldes Kohinoor, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Wesson Co.—Apr., Nov.
Ziegler, W. M., Tool Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.

STOCK FEEDS

Armstrong Bros. Mfg. Co.—Mar.
Balas Collet Mfg. Co.—July
Benco Collet Mfg. Co.—June, Nov.
Boyar-Schultz Corp.—Aug.
Detroit Power Screwdriver Co.—Jan., Mar., May, July, Sept.
Dickerman, H. E., Mfg. Co.—Jan., Mar., May, Sept., Oct., Nov.
Erickson Tool Co.—Mar.
Hardinge Brothers, Inc.—Feb., Mar., July, Oct.
Hydraulic Press Mfg. Co., Hydraulic Power Division—June
Lipe-Rollway, Inc.—Mar., Apr., June, Sept., Oct., Nov.
Littell, F. J., Machine Co.—Jan., Mar., May, July, Sept., Nov.
Perry Equipment & Engineering Co.—May, Sept.
Reed Rolled Thread Die Co.—Sept.
Sutton Tool Co.—Aug.
Syntron Co.—Feb., Mar., Apr., June, Sept., Nov.
Twentieth Century Mfg. Co.—July
U. S. Tool Co., Inc.—Mar., Nov.

CUTTERS (Incl. Broaches) DRILLS, REAMERS, COUNTERBORES, CUTOFF TOOLS, ETC.

Ace Drill Corp.—Sept., Nov.
Adamas Carbide Corp.—June, Oct.
Allegheny Ludlum Steel Corp.—June, July
American Broach & Machine Co., Division of Sundstrand Machine Tool Co.—May
Apex Tool & Cutter Co.—Feb., Mar., July, Sept.
Armstrong-Blum Mfg. Co.—Feb., July, Sept., Oct., Dec.
Atkins Saw Division, Borg-Warner Corp.—Mar., June, July, Oct.
Atrax Co., The—Aug., Dec.
Behr-Manning Corp.—Feb.
Besly-Welles Corp.—Apr., May, June, Sept., Oct.
Black Drill Co.—Apr., Oct.
Butterfield Division, Union Twist Drill Co.—May
Carboloy, Department of General Electric Co.—Mar., Sept., Dec.
Carlton Machine Tool Co.—Sept.
Circular Tool Co., Inc.—Jan., Mar., May, July, Sept., Nov.
Cleveland Twist Drill Co.—Feb., Apr., June, Aug., Oct., Dec.
Davis Boring Tool Division, Giddings & Lewis Machine Tool Co.—Feb., Sept.
Detroit Broach Co.—June
Detroit Reamer & Tool Co.—Feb., Mar., June, Aug.
Detterbeck, Geo. L., Co.—Feb., Aug.
DoALL Co.—May, Oct.
duMont Corp., The—Jan., Mar.
Eclipse Counterbore Co.—Jan., Mar., Apr., July, Sept., Nov.
Elgin National Watch Co.—Apr., Aug., Dec.
Ex-Cell-O Corp., Continental Tool Works Division—Jan., June, Oct.
Firth-Loach Metals, Inc.—Oct.
Firth-Sterling, Inc.—July
Gairing Tool Co.—Mar., May, July
Gammons-Hoaglund Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Genesee Mfg. Co.—Feb., June
Greenfield Tap & Die Corp.—May, July
Haynes Stellite Co., A Division of Union Carbide & Carbon Corp.—Feb., Apr., June, Dec.
Heller Machine Co.—Sept., Oct., Dec.
Illinois Tool Works—Dec.
Ingersoll Milling Machine Co.—Mar., May, June, Sept., Nov.
Jarvis Corp.—Mar., July, Sept.
Kennametal, Inc.—Jan., June, Aug., Sept., Oct., Nov., Dec.
Lapointe Machine Tool Co.—May
Lavallee & Ide, Inc.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Levin, Louis & Son, Inc.—Jan., Mar., June, July, Oct.
Lovejoy Tool Co.—Feb., Mar., Apr., May, July, Aug., Sept., Oct., Nov.
Madison Mfg. Co.—Oct., Dec.
Mallory, P. R., & Co.—Feb., Aug., Sept.
Melin Tool Co., Inc.—Feb., Apr., June, Oct., Dec.
Metal Carbides Corp.—Jan., Feb., May, July, Nov.
Meyers, W. F., Co.—Mar.
Mohawk Tools, Inc.—Mar., May, July, Sept., Nov.
Moline Tool Co.—Mar., May
Morse Twist Drill & Machine Co.—Jan., Mar., Apr., May, June, July, Aug., Sept., Nov., Dec.
Motch & Merryweather Machinery Co., The—Jan., Mar., May, Sept.
National Broach & Machine Co.—Jan.
National Twist Drill & Tool Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Nelco Tool Co., Inc.—Jan., Feb., Mar., July, Sept., Nov.
Nobur Mfg. Co.—Feb.
Ohio Knife Co., The—Jan.
O. K. Tool Company, Inc.—Mar., June, Sept., Oct., Nov.
Portage Double Quick Tool Co.—Feb.
Pratt & Whitney Co., Inc.—Feb., Aug., Nov.
Putnam Tool Co.—May, July, Sept., Nov.
Quality Tool Works—Feb., Mar., Apr.
R-B Tool Co., Inc.—Apr.
Rehnberg-Jacobson Co.—Aug.
Severance Tool Industries, Inc.—Feb., May, Aug., Nov.
Simonds Saw & Steel Co.—Feb., Mar., Apr., May, Sept., Oct., Nov.
Sonnet Tool & Mfg. Co.—Apr., June
Standard Tool Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Nov., Dec.
Staples Tool Co.—Mar., May, July, Sept.
Starrett, L. S., Co., The—Mar., Sept.
Super Tool Co.—Mar., May, Sept., Oct., Nov.
Threadwell Tap & Die Co.—Mar., May, July, Sept.
Tomkins-Johnson Co.—Aug.
Twentieth Century Mfg. Co.—Jan., Mar., May, July, Sept., Nov.
Union Twist Drill Co.—Feb., Mar., Apr., Sept., Oct., Nov.
Valenite Metals Corp.—Feb., June
Vanadium-Alloys Steel Co.—Jan., Nov.
Vascoloy-Ramet Mfg. Corp.—Feb., Aug., Nov.
Wadell Equipment Co.—Jan.
Waldes Kohinoor, Inc.—Aug.
Warwick Twist Drill Co.—May
Waukesha Tool Co.—Feb., Mar., Apr., May
Wesson Co.—Jan., Feb., Mar., May, June, Aug., Sept., Oct., Nov., Dec.
Willey's Carbide Tool Co.—June, Sept., Oct., Dec.
Woodson Tool Co.—Mar., June, Sept., Dec.

GRINDING WHEELS AND DRESSERS; ABRASIVES, ABRASIVE BELTS, AND DISCS

Allison Co., The, Division of American Chain & Cable Co.—Jan., Mar., May, Sept., Dec.
Barnes Drill Co.—Feb., Mar., Sept.
Bay State Abrasive Products Co.—Jan., May, July, Sept., Nov.
Behr-Manning Corp.—Jan., Aug., Oct.
Elgin National Watch Co.—June
Elox Corporation of Michigan—Mar.
Engis Equipment Co.—Feb., Apr., June
Industrial Diamond Association of America—Feb., Apr., June
Jarvis Corp.—July
Macklin Co.—Mar., Apr., June, Sept., Oct., Nov.
Metal Carbides Corp.—July
Norton Co.—Jan., Feb., Mar., Apr., June, July, Aug., Oct., Nov., Dec.
Raybestos-Manhattan, Inc., Manhattan Rubber Division—Jan., Mar., June, Sept., Nov., Dec.
Simonds Abrasive Co.—Jan., Mar., May, June, Sept., Nov.
Smit, Anton, & Co., Inc.—Feb., Apr., June, Aug., Oct., Dec.
Wheel Trueing Tool Co.—Sept.

TAPS AND DIES

Bath, John, Co., Inc.—Feb., Apr., June, Aug., Sept., Nov.
Bay State Tap & Die Co.—Feb., Apr., June, Aug., Oct., Dec.
Besly-Welles Corp.—Apr., May, June
Butterfield Division, Union Twist Drill Co.—Nov.
Card, S. W., Division, Union Twist Drill Co.—Mar., May, Sept., Nov.
Consolidated Machine Tool Co.—May, June
Detroit Die Set Corp.—June
Greenfield Tap & Die Corp.—Jan., July, Nov.
Hy-Pro Tool Co.—Jan.
Jahn, B., Mfg. Co., The—Jan.
Jarvis Corp.—July, Sept.
Morse Twist Drill & Machine Co.—Feb., Mar., May, June, July, Sept., Oct.
National Twist Drill & Tool Co.—Jan., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
New England Tap Co.—Dec.
Pratt & Whitney Co., Inc.—May
Reed Rolled Thread Die Co.—Oct.
Rehnberg-Jacobson Co.—Aug.
Standard Tool Co.—Jan., Feb., Apr., May, June, July
Threadwell Tap & Die Co.—Mar., July, Nov.
Union Twist Drill Co.—Mar., Sept.
Wood & Spencer Co.—Oct., Nov., Dec.

PUNCHES AND DIES

Accurate Bushing Co.—July
Acme-Danneman Co., Inc., Danneman Die Set Division—Mar.
Acme Industrial Co.—Mar.
Allen Mfg. Co.—Aug.
Commando Tool, Inc.—Mar., Sept.
Danly Machine Specialties, Inc.—Jan., Feb., Mar., Apr., May, June, July, Sept., Oct., Nov., Dec.
Dazor Mfg. Corp.—Sept.
Detroit Die Set Corp.—Feb., Apr., Aug., Oct., Dec.
Jahn, B., Mfg. Co.—Feb., Mar., May, Sept., Oct.
Lamina Dies & Tools, Inc.—Apr.
Mikay Co.—Sept.
Producto Machine Co.—Feb., Apr., June, Sept., Nov.
Ren-Ite Plastics, Inc.—July
Richard Brothers Punch Division, Allied Products Corp.—Jan., Mar., May, Aug., Oct.
Ring Punch & Die Co.—Mar., May, Sept., Oct., Nov., Dec.
Steel Products Engineering Co.—July
Superior Steel Products Corp.—Jan., Feb.
Vlier Engineering, Inc.—Nov.
Ward Machinery Co.—Feb.
Whister, S. B., & Sons, Inc.—Mar., May, July, Nov.

PORTABLE POWER TOOLS

Chicago Pneumatic Tool Co.—Apr., May, July, Aug., Dec.
Ingersoll-Rand, Inc.—Mar., Dec.
Jarvis Corp.—July
Keller Tool Division, Gardner-Denver Corp.—Feb., Apr., July, Aug., Sept., Dec.
M-B Products—Feb., Apr., June, Sept.
Precise Products Corp.—Oct., Nov.
Rotor Tool Co.—Jan., Apr., May, June, July, Aug., Sept., Nov., Dec.
Sundstrand Machine Tool Co.—May

HAND TOOLS

Bay State Abrasive Products Co.—Mar.
Ideal Industries, Inc.—May
O'Neil-Irwin Mfg. Co.—Apr.
Palley Supply Co.—Feb.
Rotor Tool Co.—Mar.
Sturtevant, P. A., Co.—Jan., Mar., May, July, Sept., Nov.

MARKING EQUIPMENT

Dykem Co., The—June
Hoggson & Pettis Mfg. Co.—Feb., Apr., June, Aug., Oct., Dec.
Ideal Industries, Inc.—Mar., May
Matthews, Jas. H., & Co.—Jan., Apr., May, June, Sept., Oct., Nov., Dec.
Noble & Westbrook Mfg. Co.—Sept., Oct., Nov.
Parker Stamp Works, Inc.—Jan., Feb., Mar., May, June, Aug., Sept., Oct., Dec.
Schmidt, Geo. T., Co.—Sept., Oct., Dec.

LUBRICATING EQUIPMENT & COOLANTS

Anderson, F. E., Oil Co.—Jan., Mar., Apr., May, June, Aug., Sept., Oct., Nov., Dec.
Barnes Drill Co.—Jan., Feb., Mar., Apr., June, Oct.
Gulf Oil Corp.—Mar., Apr., June, Sept.
Johnson, S. C., & Son, Inc.—Apr.
Metal Lubricants Co.—May.
Motch & Merryweather Machinery Co., The—July, Nov.
Norgren, C. A., Co.—Feb., Apr., June, Nov.
Pennsylvania Salt Mfg. Co.—Mar., May.
Production Specialties, Inc.—Jan., Feb., Mar., May.
Ruthman Machinery Co.—Jan., Mar., May, July, Sept., Nov.
Shell Oil Co.—June, July, Aug., Nov.
Stuart, D. A., Oil Co., Ltd.—Feb., Apr., July, Aug., Sept., Oct., Nov., Dec.
Sun Oil Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
White & Bagley Co, Inc.—Apr., June, Aug., Oct., Dec.

OTHER METALWORKING EQUIPMENT & MACHINES

Air-Mite, Inc.—Feb.
American Roller Die Corp.—Feb.
Benchmaster Mfg. Co.—Mar., June.
Blake, Edward, Co.—Jan.
Bodine Corp., The—Feb., Apr.
Dahlstrom Machine Works—Feb.
Deakin, J. Arthur, & Son, Inc.—Dec.
Detroit Power Screwdriver Co.—Nov.
Detterbeck, Geo. L., Co.—Feb.
Elox Corporation of Michigan—Oct., Nov.
Gorton, George, Machine Co.—Jan., Nov.
Heller Machine Co.—Sept., Oct., Dec.
Ideal Industries, Inc.—Mar., May.
Keller Tool Division, Gardner-Denver Corp.—Jan., May.
McKay Machine Co.—May, July, Sept., Oct.
Mettler Machine Tool Co.—Mar., May.
Morton Mfg. Co.—Sept.
Nilson, A. H., Machine Co.—Feb., Mar., Apr., Oct., Dec.
O'Neil-Irwin Mfg. Co.—Feb., June, Oct.
Pines Engineering Co.—Sept.
Pratt & Whitney Co., Inc.—Dec.
Rehnberg-Jacobson Mfg. Co.—Mar., Sept.
Scherr, Geo., Optical Tools, Inc., Division of Geo. Scherr Co.—Oct.
Steel Products Engineering Co.—July, Sept., Nov.
Tracer Control Co.—Dec.
True-Trace Sales Corp.—Nov.
U. S. Tool Co., Inc.—July.
United States Rubber Co.—July.
Universal Engineering Co.—May.
Yoder Co., The—Feb., Mar., Apr., May, Sept., Oct.

FORMING, FORGING, CASTING

MECHANICAL PRESSES

Air-Mite, Inc.—June.
Baird Machine Co.—July.
Benchmaster Mfg. Co.—Apr.
Bliss, E. W., Co.—Sept.
Bodine Corp., The—June.
Clearing Machine Corp., Division of U. S. Industries, Inc.—Jan., Mar., May, Sept., Nov.
Comtor Co.—Oct.
General Mfg. Co.—Feb.
Kenco Mfg. Co.—Dec.
Kling Bros. Engineering Works—May, Nov.
Niagara Machine & Tool Works—Jan., Mar., July.
Nilson, A. H., Machine Co.—Aug.
Palley Supply Co.—Jan., Feb.
Pines Engineering Co.—June, Aug., Nov.
Richards, J. A., Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Sales Service Machine Tool Co.—Feb., Mar., May, Sept., Oct., Nov.
Service Machine Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Thunder Bay Mfg. Corp.—Mar.
U. S. Tool Co., Inc.—Jan., May.
V & O Press Co., The, Division of Emhart Mfg. Co.—Mar., June, Sept., Nov.
Verson AllSteel Press Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Dec.

HYDRAULIC PRESSES

Acme Broach Corp., Acme Press Division—Sept.
Air-Mite Devices, Inc.—Sept.
Clearing Machine Corp., Division of U. S. Industries, Inc.—Aug.
Denison Engineering Co., The—Sept., Nov.
Hydraulic Press Mfg. Co., Hydraulic Power Division—Aug.
Lobdell United Division, United Engineering & Foundry Co.—Mar.
Niagara Machine & Tool Works—May, Nov.
O'Neil-Irwin Mfg. Co.—Apr.
Palley Supply Co.—Mar.
Verson AllSteel Press Co.—Feb., July, Nov.

BRAKES AND SHEARS

Boyar-Schultz Corp.—Dec.
Cincinnati Shaper Co.—Feb., Mar., May, June, July, Aug., Sept., Oct., Nov.
Cleveland Crane & Engineering Co.—Jan., Mar., July, Nov.
Kling Bros. Engineering Works—Mar., May, July, Sept., Nov.
Niagara Machine & Tool Works—Jan., Sept.
O'Neil-Irwin Mfg. Co.—Aug.

FORGING EQUIPMENT

Torrington Co., The—Mar., Apr., June, Nov., Dec.

PUNCHING, NOTCHING & NIBBLING MACHINES

Allen, Alva F.—Mar., July.
Benchmaster Mfg. Co.—Feb.
Chicago Rivet & Machine Co.—Feb., Apr., June, Aug., Oct., Dec.
Hannifin Corp.—Feb., Apr.
Hill Machine Co.—Dec.
Keller Tool Division, Gardner-Denver Corp.—Nov.
Kenco Mfg. Co.—Mar., Oct., Nov.
Kling Bros. Engineering Works—July, Nov.
Tomkins-Johnson Co.—Dec.
Torrington Co., The—Aug.
Wales-Strippit Corp.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov.
Whistler, S. B., & Sons, Inc.—Jan., Sept.
Wiedemann Machine Co.—Jan., Feb., Mar., June, Sept.

WELDING AND HEAT-TREATING

GAS WELDING AND CUTTING

Lincoln Electric Co.—July.

ELECTRIC WELDING

Cleveland Crane & Engineering Co., The—May.
Lincoln Electric Co.—Mar., May, Nov.

WELDING ACCESSORIES

Erickson Tool Co.—Nov.
Handy & Harman—Feb., Mar., June, Sept., Oct., Nov.
Lincoln Electric Co.—Nov.

FURNACES AND HEATERS

Cincinnati Milling Machine Co.—Oct.
Lepel High Frequency Laboratories, Inc.—Jan., Mar., May, July, Sept., Nov.
Lindberg Engineering Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Ohio Crankshaft Co., The—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Sentry Co.—Feb., Apr., June, Aug., Nov., Dec.

LAYOUT AND INSPECTION

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Airborne Accessories Corp.—Jan.
Alina Corp.—Mar., Oct., Dec.
Ames, B. C., Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Ames Precision Machine Works—Jan., Mar.
Barnes, W. F. & John, Co.—Feb.
Bath, John, Co., Inc.—Jan., Mar., May, July, Oct., Dec.
Besly-Welles Corp.—Sept., Oct.
Boice Mfg. Co.—Mar.
Brown & Sharpe Mfg. Co.—Sept.
Brush Electronics Co.—Feb., Mar., May, July, Sept., Nov.
Cadillac Gage Co.—Jan., Apr., Oct.
Carboloy, Department of General Electric Co.—Sept., Oct., Nov., Dec.
Card, S. W., Division, Union Twist Drill Co.—Feb., Mar., Nov.
Chicago Dial Indicator Co.—Mar., Sept.
Cleveland Crane & Engineering Co., The—Sept.
Comtor Co.—Apr., May, June, July, Aug., Sept., Nov., Dec.
Consolidated Engineering Corp.—July.
Davis, A. G., Gage & Eng. Co.—Dec.
Deltronic Corp.—Jan., Mar., May, July, Sept., Nov.
Dillon, W. C., & Co.—Jan., May.
DoALL Co.—Apr., Dec.
Eastman Kodak Co.—Feb., Apr., June, Aug., Oct., Dec.
Engis Equipment Co.—Sept., Oct., Dec.
Ercona Corp.—Mar.
Federal Products Corp.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Foster Engineering Corp.—Jan., Mar.
Gaertner Scientific Corp.—Jan., Mar., May, July, Sept., Nov.
Gisholt Machine Co.—Jan., Feb., Apr., May, June, Aug., Oct., Dec.
Greenfield Tap & Die Co.—July.
Griswold, F. T., Mfg. Co.—Mar.
Ideal Industries, Inc.—Mar.
Industrial Gages, Inc.—Sept.
Lincoln Gage Co.—Nov.
Lincoln Park Industries, Inc.—Sept., Nov.
Lufkin Rule Co.—Apr., Sept., Oct., Nov.
Madison Mfg. Co.—Mar.
Merrill Engineering Laboratories—Mar.
Merz Engineering, Inc.—Mar.
Morris Machine Tool Co.—Oct.
Morse, H. E., Co.—June.
National Twist Drill & Tool Co.—Feb., Mar., Apr., May, June, Aug., Sept., Oct.
New Standard Division, U. S. Expansion Bolt Co.—Mar., May, July.
Pipe Machinery Co.—Sept., Nov., Dec.
Pratt & Whitney Co., Inc.—July, Sept., Dec.
Reliant Gage & Supply Co.—Jan., Mar., May, Aug., Oct., Dec.
Rimat Tool Co.—Mar.
Robbins, Omer E., Co.—Feb.
Scherr, Geo., Co., Inc.—Jan., Feb., May, July, Aug., Dec.
Scully-Jones & Co.—Mar.
Sheffield Corp., The—Mar., July, Nov.
Standard Gage Co., Inc.—Feb., Mar., Apr., June, July, Aug., Sept., Oct., Nov., Dec.
Standard Tool Co.—Sept., Oct.
Starrett, L. S., Co.—Jan., Mar., Apr., Sept., Nov., Dec.
Steel City Testing Machines—Mar.
Taft-Peirce Mfg. Co.—Mar., Apr., May, June, July, Aug., Sept., Dec.
Taylor Dynamometer and Machine Co.—Feb., Sept.
Threadwell Tap & Die Co.—Jan., Mar., May, July, Sept.
Van Keuren Co., The—Feb., Mar., May, July, Oct.
Webber Gage Co.—Feb., Mar.
Wilson Mechanical Instrument Division, American Chain & Cable Co.—Jan., Mar., May, July, Sept., Nov.

COMPARATORS AND LAYOUT EQUIPMENT

Cadillac Gage Co.—July.
Collins Microflat Co.—Sept.
DoALL Co.—Apr., Dec.
duMont Corp., The—Jan.
Dykem Co., The—Jan., Feb., Mar., Apr., May, July, Sept., Oct., Nov., Dec.
Eastman Kodak Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Hardinge Brothers, Inc.—Mar.
Lawley Granite Surface Plate Co.—Mar., Sept.
National Twist Drill & Tool Co., Winter Brothers Division—Nov.
Palley Supply Co.—Mar.
Pratt & Whitney Co., Inc.—June.
Reliant Gage & Supply Co.—Mar., May, Aug.
Robbins, Omer E., Co.—June, Aug., Dec.
Scherr, Geo., Co., Inc.—Mar., June, Nov.
Standard Gage Co., Inc.—Jan.
Starrett, L. S., Co.—Mar., Sept.
Taft-Peirce Mfg. Co.—Apr., June, Aug., Oct., Nov., Dec.
Williams, S. J., Precision Tool Kits, Inc.—May.

CLEANING, FINISHING AND CHEMICAL TESTING

CLEANING

Fuller Brush Co., The—Jan., Feb., Mar., July.
McKay Machine Co., The—Mar.
Mettler Machine Co.—Jan.
Oakite Products, Inc.—Jan., Feb., Mar., Apr., May, June, Aug., Sept., Oct., Nov.
Osborn Mfg. Co.—Mar., Apr., Nov., Dec.

FINISHING

Linde Air Products Co., A Division of Union Carbide & Carbon Corp.—July, Sept.
Oakite Products, Inc.—Dec.

CHEMICAL TREATING

Armor-Tuf Sales Corp.—June.
Linde Air Products Co., A Division of Union Carbide & Carbon Corp.—Apr.
Pennsylvania Salt Mfg. Co.—Jan.

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American Monorail Co.—Jan., Mar., May, July.
Barnes, W. F. & John, Co.—Feb.

MISC. MATERIALS HANDLING

American Monorail Co.—Sept.
Keller Tool Division, Gardner-Denver Corp.—Oct.
Walker, O. S., Co., Inc.—July.

PUMPS

Denison Engineering Co.—Mar.
Dudco Division, The New York Air Brake Co.—Mar., Apr., May, June, July, Aug.
Rivett Lathe & Grinder Co., Inc.—Aug.

AIR COMPRESSORS, CLEANERS

Ingersoll-Rand, Inc.—Nov.
Rivett Lathe & Grinder Co., Inc.—Feb.

DRAFTING AND BLUEPRINTING

Mayline Co.—Jan., Feb., Apr., June, Aug., Oct.

MISCELLANEOUS

Dazor Mfg. Corp.—Apr., June, Oct., Dec.
Hannifin Corp.—June.
Mayline Co.—Dec.
Osborn Mfg. Co.—June, Aug.
United States Rubber Co.—Apr.

PARTS AND MATERIALS

ELECTRICAL

Barnes, W. F. & John, Co.—Feb.
Boston Gear Works—May.
Consolidated Engineering Corp.—Mar.
Marathon Electric Mfg. Corp.—Sept.

MECHANICAL

Acme Industrial Co.—Nov.
Airborne Accessories Corp.—Mar., May, Sept., Nov.
Aviation Developments, Inc.—Mar.
Boston Gear Works—Jan., May, July, Sept., Dec.
Bunting Brass & Bronze Co.—Sept.
Carlyle Johnson Machine Co.—Feb., Apr., Sept.
Huron Machine Products, Inc.—Nov.
Ingersoll-Rand, Inc.—Jan.
M-B Products—Mar.
Nice Ball Bearing Co.—Mar., July, Sept.
Ohio Knife Co., The—Mar., Apr., Sept., Oct.
Richard Brothers Punch Division, Allied Products Corp.—Dec.
Robinson Aviation, Inc.—Sept.
Superior Steel Products Corp.—Nov.
United States Rubber Co.—Mar., Aug., Sept., Nov., Dec.
Valvair Corp.—June.
Von Industries, Inc.—Sept.

HYDRAULIC

Anker-Holth Division, Wellman Engineering Co.—Mar.
Denison Engineering Co., The—Jan., Feb., Mar., May, June.
Dudco Division, The New York Air Brake Co.—Jan., Feb., Sept.
Ex-Cell-O Corp.—June.
Galland-Henning Mfg. Co.—Feb., Apr., June, Aug., Oct.
Hanna Engineering Works—Feb., Mar., May, Sept., Oct., Dec.
Hannifin Corp.—Jan., May, June, Aug., Sept., Oct., Dec.
Hydraulic Press Mfg. Co., Hydraulic Power Division—Feb., Apr., Oct., Dec.
Hydro-Line Mfg. Co.—Feb., Apr., June, July, Sept.
Lehigh, Inc.—May.
Miller Fluid Power Co.—Feb., Mar., Apr., June, July, Aug., Oct., Dec.
Modernair Corp.—Jan., May, July, Nov.
Norgren, C. A., Co.—Sept., Oct.
Ortman-Miller Machine Co.—Jan., Feb., Mar., Apr., May, July, Aug., Sept., Oct., Nov., Dec.
Palley Supply Co.—Mar.
Perry Equipment & Engineering Co.—Jan.
Rivett Lathe & Grinder Co., Inc.—Jan., Mar., Apr., Oct., Nov.
S-P Mfg. Corp.—Feb., Oct.
Schrader's, A., Son, Division of Scoville Mfg. Co.—Oct.
Tomkins-Johnson Co.—Feb., Mar., June, Sept.
True-Trace Sales Corp.—Dec.
United States Rubber Co.—Oct.

PNEUMATIC

Airmatic Valves, Inc.—Mar.
Air-Mite, Inc.—Apr., Oct., Dec.
Barksdale Valves—Oct., Nov., Dec.
Bellows Co., The—Jan., Apr., May, June, Aug., Sept., Oct., Nov.
Galland-Henning Mfg. Co.—Feb., Apr., June, Aug., Oct.
Hanna Engineering Works—Mar., Sept., Oct., Dec.
Hannifin Corp.—Jan., Mar., May, Aug., Sept., Oct., Nov., Dec.
Hydro-Line Mfg. Co.—Feb.
Ingersoll-Rand, Inc.—June, Sept.
Lehigh, Inc.—Mar., July, Sept.
Metal Carbides Corp.—June.
Miller Fluid Power Co.—Jan., Apr., May, June, Oct.
Modernair Corp.—Jan., Mar., May, July, Sept.
National Automatic Tool Co., Inc.—Mar.
Norgren, C. A., Co.—Sept., Oct.
Ortman-Miller Machine Co.—Jan., Feb., Mar., Apr., May, June, Sept., Oct., Nov., Dec.
Rivett Lathe & Grinder Co., Inc.—June.
S-P Mfg. Corp.—June.
Schrader's, A., Son, Inc., Division of Scoville Mfg. Co.—Feb., Apr., June, Aug., Oct., Dec.
Valvair Corp.—Mar., Apr.

FASTENING DEVICES

Allen Mfg. Co.—Feb., Apr., June, Oct., Dec.
Bagshaw, W. H., Co., Inc.—Jan.
Bristol Co., The—Mar., Apr., June, Sept., Oct., Dec.
Danly Machine Specialties, Inc.—Aug.
Hassall, John, Inc.—Mar., June, Sept.
Milford Rivet & Machine Co.—Mar.
Ottemiller, Wm. H., Co.—Jan., Feb., Apr., June, Aug., Oct., Dec.
Parker-Kalon Corp.—Feb., Mar., May, July, Sept., Nov.
Production Specialties, Inc.—Apr.
Standard Pressed Steel Co.—Jan., Feb., Mar., Apr., May, June, July, Sept., Oct., Nov.
Standard Shop Equipment Co.—Apr.
Vlier Engineering, Inc.—Jan., Feb., May, Oct.

MATERIALS

Columbia Tool Steel Co.—June.
National Automatic Tool Co.—Mar.

MATERIALS—Tool & Die

Acme Industrial Co.—May.
Adamas Carbide Corp.—Feb., Apr., Aug., Dec.
Allegheny Ludlum Steel Corp.—Jan., Feb., Mar., Apr., May, Aug., Sept., Oct., Nov., Dec.
Bakelite Co., A Division of Union Carbide & Carbon Corp.—May, June, Aug., Sept., Oct., Nov.
Bethlehem Steel Co.—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Carboloy, Department of General Electric Co.—Feb., Mar., Apr., June, Aug., Oct., Dec.
Carpenter Steel Co.—Sept., Oct., Dec.
Cerro de Pasco Corp.—Mar., July.
Ciba Co., Inc.—Sept.
Columbia Tool Steel Co.—Jan., Feb., Apr., July, Aug., Sept., Nov.
Crucible Steel Company of America—Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.
Darwin & Milner, Inc.—Feb.
Dow Chemical Co.—Mar., Apr., July, Sept., Nov., Dec.
Firth-Sterling, Inc.—Mar., Apr., May, July, Sept., Nov.
Furane Plastics, Inc.—Mar., May, July, Sept., Dec.
Haynes Stellite Co., A Division of Union Carbide & Carbon Corp.—Oct.
Houghton Laboratories, Inc.—Feb., Apr., June, Aug., Nov., Dec.
Hutchinson, William T., Co.—Mar.
Jessop Steel Co.—Feb., Mar., Apr., May, July, Sept.
Kennametal, Inc.—May, July, Nov.
Latrobe Steel Co.—Mar., Apr., June, Aug., Sept., Oct.
Meehanite Metal Corp.—Nov.
Metal Carbides Corp.—Mar., Apr., May, June, Aug., Sept., Oct., Dec.
Milne, A., & Co.—Mar., Aug., Oct., Dec.
Ohio Knife Co., The—May, June.
Pioneer Tool Engineering, Inc.—Dec.
Pittsburgh Tool Steel Wire Co.—Mar.
Red Seal Metals Co.—Apr., Aug.
Ren-Ite Plastics, Inc.—May.
Rezolin, Inc.—Oct.
Simonds Saw & Steel Co.—Jan., June
Timken Roller Bearing Co.—Feb., Mar., May, Sept., Nov.
Uddeholm Company of America, Inc.—Jan., Mar., May, July, Sept., Nov.
Valenite Metals Corp.—Mar.
Vanadium-Alloys Steel Corp.—Mar., June, Aug., Sept.
Vulcan Crucible Steel Co., Division of H. K. Porter Co.—Nov., Dec.
Vulcan Tool Co.—Feb., Mar., Apr., May, June.
Wesson Co.—July, Aug.

MATERIALS—Product

American Brass Co.—Jan., Apr., May, Sept., Nov., Dec.
Ampco Metal, Inc.—Jan., June, Sept., Nov.
Bakelite Co., A Division of Union Carbide & Carbon Corp.—Aug.
Cadmet Corp.—Mar., Apr.
Carboloy, Department of General Electric Co.—Sept.
Cerro de Pasco Corp.—Jan., May, Sept., Nov.
Ciba Co., Inc.—Dec.
Composite Forgings, Inc.—Feb.
Disston, Henry, & Sons, Inc.—Feb., Apr., June, Aug., Oct., Dec.
Furane Plastics, Inc.—Dec.
Haynes Stellite Co., A Division of Union Carbide & Carbon Corp.—Aug.
Hutchinson, William T., Co.—Jan.
Meehanite Metal Corp.—Jan., Mar., May, June, Sept., Nov.
Metal Carbides Corp.—Feb., Apr., May, June, July, Aug., Dec.
Ohio Seamless Tube Division, Copperweld Mfg. Co.—Mar.
Pioneer Tool Engineering, Inc.—June, Oct.
Red Seal Metals Co.—Sept.
Ren-Ite Plastics, Inc.—Mar.
Thiokol Chemical Corp.—Nov.
Timken Roller Bearing Co.—July.

PROCESSES

Barker Engineering Co.—Apr.
U. S. Burke Machine Tool Division—Jan.

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ENGINEERING SERVICES

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Boeing Airplane Co.—Jan., Feb.
Clapp & Poliak, Inc., Production Engineering Show—July.
General Motors Corp.—Sept.
Jones & Lamson Mfg. Co.—Sept.
Lion Mfg. Corp.—Dec.
National Machine Tool Builders' Association—May, July, Sept.
Pioneer Engineering & Manufacturing Co.—Mar, May, June, Sept., Nov.
Standard Gage Co., Inc.—May.
Vulcan Tool Co.—Apr.
Wallington Sales Co.—Jan.
White-Rodgers Electric Co.—Feb.
Wiedemann Machine Co.—Nov.

PUBLICATIONS

American Society of Tool Engineers—Apr., Oct., Nov., Dec.
Anocut Engineering Co.—July, Aug.
Die Techniques Publishers Division, Falcon Engineering Co.—Apr., May, June, July, Aug., Sept.
Elgin National Watch Co.—Oct., Dec.
Firth-Sterling, Inc.—Mar.
Gisholt Machine Co.—Jan.
Jansson Gage Co.—Oct., Dec.
Jarvis Corp.—Sept.
Lamina Dies & Tools, Inc.—Feb.
Lobdell United Division, United Engineering and Foundry Co.—Apr.
Oakite Products, Inc.—Mar., July.
Rezolin, Inc.—Mar.
Ring Punch & Die Co.—July.
Standard Parts Co.—Sept., Oct., Nov., Dec.
Super Tool Co.—Jan.
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January 1956 Issue

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*Exhibitor in ASTE Western Industrial Exposition

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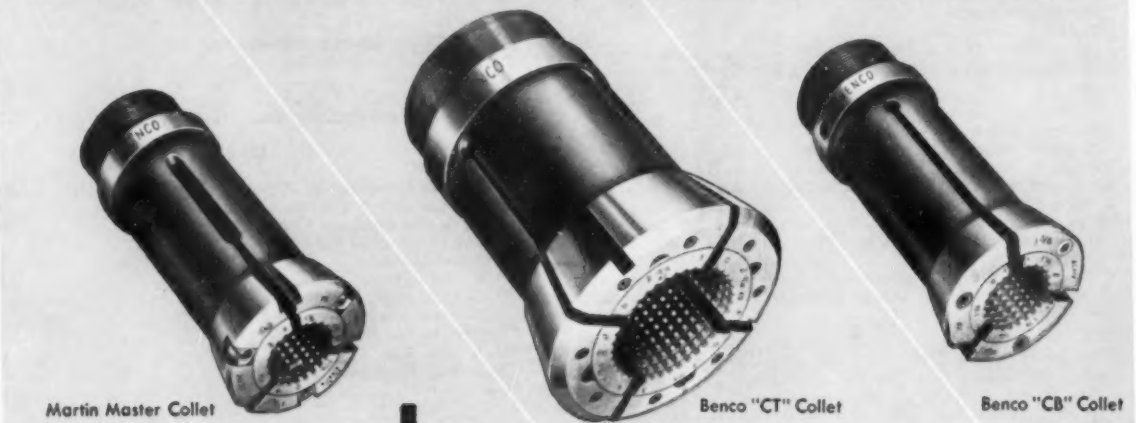

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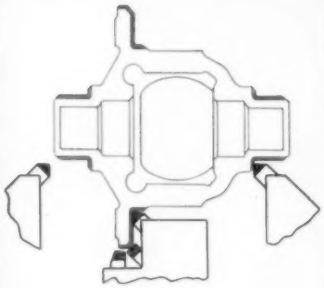
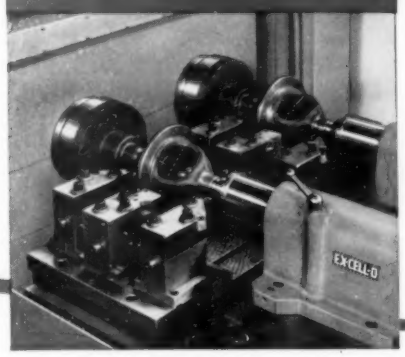


Heavy lines show the surfaces machined.



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